HOUSE-PAINTING.

HOW SHALL WE PAINT OUR HOUSES?

A POPULAR TREATISE

ON THE ART OF

HOUSE-PAINTING:

PLAIN AND DECORATIVE.

SHOWING THE NATURE, COMPOSITION AND MODE OF PRODUCTION OF PAINTS AND PAINTERS' COLORS, AND THEIR PROPER AND HARMONIOUS COMBINATION AND ARRANGEMENT.

BY
JOHN W. MASURY.

NEW YORK:
D. APPLETON & CO., 90, 92 & 94 GRAND STREET.
1868.

CONTENTS.

CHAPTER XXV.

CHAPTER XXVI.

CHAPTER XXVII.

INTRODUCTORY CHAPTER.

"Of making many books there is no end."—*Eccles.* xii., 12.

In the multitude of books treating of every conceivable subject and matter—serious and comic; religious and secular; arts, commerce, and philosophy; architecture, farming, landscape gardening, politics, law, inventions, discoveries, etc., etc.—which have issued from the prolific press of America during the last fifty years, one would naturally conclude that no stone had been left unturned, no field ungleaned, no subject available either for profit or pleasure, undisposed of. With multiplied facilities for publishing and advertising, authors have increased, and all the realms of space and thought, of the past and the future, the actual and the ideal, heaven and earth, and "the third estate," have been ransacked for topics on which, or about which, "to write a book." The boast of Glendower, that he could "call spirits from the vasty deep," has been more than realized by our modern rappers, and communications by spiritual telegraph from the shades of the "great departed" may be had for a consideration. The present abiding-place of those gone before has been visited, and the "secrets of the prison-house"—revealed in book form—may be purchased for a trifle.

There is, however, one subject at least which has not, so far, drawn to itself the attention of the book-makers, or which has not been considered of sufficient importance to justify the outlay of time and money which its publication must of necessity involve. Yet it is one which comes home to us all, and on which, in no small degree, depend our comfort, our pleasure, and our health. The art of House-Painting, *by itself*, has not, to the best knowledge and belief of the writer, been made the subject of a book; nor is the task begun now with any expectation of pecuniary reward, but simply as a labor of love, in the hope that some may find instruction in its pages, and that all who shall honor the writer by its perusal, may be led to a better appreciation of the importance of the subject.

If house-painting consisted of merely covering the wood-work of a dwelling with one or more coats of white paint, to speak of it as a fine art, would hardly be justifiable; but so far is such from being the case, that to conduct successfully the business of painting in our cities and larger towns, requires the exercise of those faculties which, in general acceptation, are supposed to distinguish the artist from the mechanic. An eye prompt by nature and education to distinguish the nice gradations of colors and tints—and the faculty so to arrange and dispose them as shall best harmonize them with each other, and with the surroundings—are indispensable requisites in the house-painter of the present day.

Happily, the day of dead whites for the

interiors of our dwellings has passed by—let us hope, not to return. It was a kind of Puritanism in painting, for which there was no warrant in Nature, which, in such matters, should be our teacher and guide. If we go to her humbly, as little children, for instruction, she will point us to the vaulted arch above, frescoed by day with a thousand shapes and hues of beauty and loveliness, and by night with myriads of stars; to the cool gray tints of the morning twilight, and the gorgeous blazonings of the summer sunset. She will show us a landscape whereon, with lavish hand, she has painted forms of beauty of every color, and tint, and hue, and shade, and pencilled with exquisite touches the tiniest leaf. But the subject must not be considered only in its æsthetic aspect, not alone as adding beauty and comeliness to our homes, but in its economical aspect, as most important in preserving wood from the action of the weather, in excluding dampness, and arresting mouldiness and decay. It is, too, highly promotive of that "cleanliness which is next to godliness," and affords the best outward sign of the advance of a people in the path of civilization: for just in proportion as the houses, fences, and outbuildings of a community, are painted or neglected, will be the advance of that people in wealth, literature, home-comforts, in short, all the consequences and refining influences of a high civilization. That this is true, of our own country at least, appeal is made to those who have travelled much, and have thereby acquired the experience necessary to the forming of a correct conclusion.

Indeed, one feels as he leaves behind him the freshly-painted houses and lattice-fences of the older and more thrifty portions of our land, and finds himself surrounded by the evidences of a ruder cultivation, that this condition is owing in a greater or less degree to the absence of the house-painter and his stock of paints.

A knowledge of the materials employed

in the prosecution of any trade, profession, or calling, their source, origin, nature, effects, and properties, and the mode and manner in which they are influenced by the invisible forces of Nature, ever active in the great law of change, would seem to be a necessary concomitant of success.

The materials used by the painter and colorist, are more directly the result of chemical research, and discovery, than are those of other trades and callings; and no amount of observation and study, without the assistance of written explanations, will give the clew to their composition and mode of production. The wood which the carpenter fashions into shapes of utility and beauty, bears in its grain the story of its growth. The nails which he uses are familiar as household words, and of themselves suggest the mechanical force which fashioned them. But the materials which reflect to the eye the thousand tints and colors which the painter disposes with cunning hand, give no sign of the secret of their origin.

They may be simple or compound substances wrought out in Nature's vast laboratory, or the result of the highest scientific skill.

The aim of the writer has been to give, in as brief a form as possible, the mode of operation in the production of the factitious pigments used in house-painting, and to explain the origin and properties of those which are of Nature's own production.

There is nothing in domestic or out-door life so common—so constantly before our eyes—as painted surfaces; yet, outside the ranks of those who profess the art of painting, there prevails a general ignorance of the nature and composition of paints, and of the proper and economical use of the same.

Owing to what the writer must call a defect in our system of education, not only in our common schools, but in the higher institutions of learning, no effort is made to educate the perceptive faculties in the discrimination of colors, or in their harmonious combination and arrangement. Such teaching is certainly worthy the attention of those to whom we commit the instruction of our children, and the neglect of it is a national misfortune.

Hoping to create an interest in this important subject, the writer is induced to offer this little book to the public, and would modestly commend it not only to the trade, but also to the general reader, with the belief that there are but few who may not find some instruction in its pages.

CHAPTER II.

THE ART OF HOUSE-PAINTING.

When Christian civilization summons her recruits and sets out on the "march of empire" toward the setting sun, she has no welcome place in her ranks for the painter. Foremost in the van march the subduing forces, the hardy earth-worker, the woodman with his axe, and side by side with them the artificer in iron, the great and crowning glory of all; indeed, without him the *first step* cannot be taken, for the hammer of Tubal Cain must give the note of busy preparation. When the sanctity of Eden was violated, and the edict went forth, "In the sweat of thy face shalt thou eat bread," Tubal Cain, the instructor, appeared first among the workers, and that place he must ever maintain. The hammer and good right arm of Tubal must be most honored among the emblems which teach the story of obedience to that command, to "replenish and subdue the earth." But for him the forests would bar the advancing hosts, and the earth refuse her increase. Nor is the painter found among the camp-followers of the advancing army, but he comes when peace and plenty reign, and abundant harvests give promise of leisure for the cultivation of that love of the beautiful in art for which the hand of rude necessity had no welcome.

The business of house-painting has so outgrown its former insignificant proportions, that its past and present features have almost lost their resemblance. To-day, more money is expended in the painting of a single edifice than would have sufficed to paint every house in a respectable-sized town thirty years ago; and the amount of capital, skill and intelligence now required to conduct the business successfully in the cities and large towns, was not dreamed of at that time. The services of the painter are better acknowledged and appreciated, and his labor more adequately rewarded, than formerly. The business tact, knowledge, skill and capital of employers, in many cases, meet with ample but deserved remuneration, for the business seems to be attended with more than its fair share of the vexations and annoyances which, to a greater or less degree, appertain to all the various branches of the mechanic arts.

One of the most serious difficulties with which the employing painter contends is that of obtaining the services of skilful, reliable workmen, during what is called the busy season.

This grows out of the fact, partly, that a large proportion of repainting, interiors particularly, is crowded into the brief season of spring, and partly from the idea that once generally prevailed, and which unfortunately obtains now to some extent, that anybody can do plain painting, and that the art of mixing and laying on of colors requires less skill, and is more easily acquired, than skill and dexterity in other trades.

During this brief busy season, the employer, under the pressure of necessity, avails himself of such workmen as present themselves; some of them, perhaps, fresh from the lapstone and the last, who have stepped from the shoemaker's bench to the paint-brush, as if the same were a natural and proper transition.

The elements, too, conspire against the painter: a sudden shower will sometimes produce a most undesirable commingling of tints, blending black, white and gray in streaky confusion. The dust-plague, too, is ofttimes a double plague to him. A change of temperature may check the drying disposition of his pigments, for the property of absorbing oxygen, which the oil possesses at ordinary temperatures, seems to be wanting under certain atmospheric conditions.

Clamorous housekeepers exact promises which are made for the sake of peace, too often, alas! only to be broken. The disordered condition of the household, extended far beyond the stipulated time, is added to his unavoidable sins of omission, and many a brave "boss" has beaten a hasty and inglorious retreat, rather than meet the unmerited rebuke of an angry and disappointed housekeeper. But there is one drop of comfort which the painter shares not in common with other craftsmen. His coming always gives satisfaction and meets a ready welcome, and the doors close behind him, when his work is completed, with intensified delight.

Formerly, a slab and muller were indispensable articles in the furniture of the paint-shop. These have been in a great measure superseded by the iron paint-mill, and the latter in some degree by the introduction of ground colors put up in tin boxes (commonly called cans) of convenient size. These boxes, after the manner of fruit-cans, are sealed by soldering a patch or disk of tin over the opening through which the contents were introduced, and being hermetically closed, the paint remains unchanged until such time as it may be wanted for use.

The objection, formerly, to this mode of putting up colors, was the difficulty of opening the cans, particularly the smaller ones. This has, however, been entirely removed, by an invention which is patented, and which most effectually overcomes the difficulty before mentioned. It consists simply, in making one end of the can of thinner metal than the body and bulk of the same, so that the said end may be cut out with a penknife. To get at the contents requires but an instant of time, and may be effected without waste of material or even soiling the fingers.

For interiors of the best class of houses and public buildings, what is called fresco-painting is now the fashion. This is, properly, only an *imitation* of fresco-painting, which term, in its proper sense, signifies a method of ornamenting the walls and ceilings of buildings with colors ground in water, and mixed with lime and applied to freshly-laid plaster.

True fresco-painting was practised by the ancient Greeks, and by other nations of antiquity; and all who have travelled in Italy are familiar with the magnificent frescoes which adorn the walls and ceilings of so many churches, convents, and palaces there. After the middle of the seventeenth century, this art rapidly deteriorated. The present century has, however, witnessed its revival, and it is now practised to a considerable extent, particularly in Germany.

With us, what is called fresco-painting is simply the painting of walls and ceilings either in oil or water colors, and ornamenting the same with panels, mouldings, flowers, or other designs. The woodwork in so-called frescoed rooms, is painted in what are called parti-colors, neutral tints generally, to harmonize with the colors on the walls and ceilings. This style of interior decoration affords a fine field for the display of taste and true artistic skill; consequently, house-painting now-a-days comprehends something more than the mere mechanical operation of covering the woodwork of a house with a coat of plain white or lead-colored paint.

CHAPTER III.

PAINTS AND COLORS.

The materials from which color is extracted are obtained from all sources. Among mineral colors, the earths seem to claim the first notice, from their having been naturally the first substances employed in painting, as well as from their known durability. It would seem that these colors must of necessity be permanent; because, had they been liable to change, such change must have taken place during the ages that they remained unappropriated to the use of man. These colors, when carefully purified, are well suited for painting, where no very vivid tints are required, being generally dull (although very useful) yellows and reds. In other respects, they are excelled by mineral colors prepared by chemical agency. In brown tints, as

Vandyke Brown, Cologne earth, Umbers, Siennas, etc., however, the native earths surpass the artificial preparations.

Minute specimens of brilliant colors frequently occur among minerals, though generally found in small particles, embedded in large masses of stony material, so that their extraction, with a view to their use in painting, must be considered impracticable. They have, however, suggested to the chemist the idea of combining the same elements for the artificial production of similar results.

Native cinnabar, no doubt, suggested the idea of combining sulphur with quicksilver to produce vermilion, and but for the analysis of true ultra-marine, the artificial substitute would probably have remained undiscovered.

There is, really, no metal that does not yield pigments of some sort. MERCURY produces *Vermilion*. *Venetian Red*, *Mars Orange* and *Yellow*, and *Indian Red*, are produced from IRON. COPPER gives us *Emerald Green* and *Verdigris*. CHROMIUM affords *Oxide of*

Chromium and *Chrome Yellow*. *Kings' Yellow* and *Orpiment* are made from ARSENIC. *Cobalt Blue* and *Smalt*, from the metal COBALT. ZINC supplies *Zinc White*. LEAD supplies *White Lead*, *Krems White*, *Flake White*, *China White*, *Patent Yellow*, *Red Lead*, and *Orange Mineral*, and from the newly-discovered metals, such as CADMIUM, URANIUM, MOLYBDENUM, etc., colors of equal beauty are procurable.

Among the colors extracted from animal matter, those distinguished by the brilliant hues imparted through the agency of prussic acid are most remarkable. This peculiar acid is produced by the calcination of dried blood and the hoofs and horny parts of animals, and in conjunction with iron, it affords those beautiful and powerful blues known as *Prussian* and *Antwerp Blue*.

Gall Stone and *Indian Yellow* are both the products of animal economy, and the cochineal insect, by a particular treatment and great delicacy in manipulation, is made to yield the most powerful and beautiful crimson known, viz., the *Carmine* and *Crimson Lakes*. *Scarlet* and *Purple Lakes* are also made from the same by varying the mode of manufacture.

Vegetable Colors, from the want of permanency, are mostly rejected by the color-maker. Among the few that are retained, the Madder-root holds the most conspicuous place. The Indigo-plant and Gamboge also afford useful colors in the fine arts. Among the vegetable colors we must class *Frankfort Black* and that most important pigment *Lamp Black*.

From this brief review, it would seem that all the kingdoms of the material world, and all quarters of the globe, are laid under contribution to supply to the painter his stock of colors.

CHAPTER IV.

TRUE ECONOMY IN THE USE OF PAINTS.

THE fact cannot be too forcibly impressed on the minds of all who may be engaged in the business of painting, *that good results can be produced only by the use of good materials. The best are always the cheapest!* The main expense in painting is not in the cost of the paint, but in that of *labor* and oil, and it requires more labor to apply the *worst* than to apply the *best* paint that can be obtained. The cheapening of paints, by the admixture of adulterating materials, is carried on to the last degree, probably to a greater extent than in any other article of general use and consumption.

The *experienced* eye can with difficulty detect the difference between colors which are pure and those which are highly adulterated, the only test being actual *use* and *application.* The safe way, therefore, is to purchase such colors *only* as bear the name of some well-known and responsible manufacturer.

The writer would not, however, be understood as advising the use of the best white lead or zinc, for all kinds of painting; there are paints much more economical because more durable for outside work than these. The Ochres, or earth-paints are, for many purposes, the best and cheapest. Paints are durable mainly because of the water-proof quality of the oil in which they are used. Some paints, the Ochres for instance, are inert substances, and do not, in any degree, change the nature of the oil; while others, such as white lead, affect the oil chemically, and impair, in a measure, its tenacity, its property of resisting the action of water and the sun's rays.

Much of outside wood-work is painted simply to preserve it from the action of the weather, color and appearance being in such cases unimportant considerations. Hence, it follows, that whatever material will most economically produce this result, is the most desirable, regardless of the name it may bear.

The natural deposits of Ochres (colored earths) belong, to what is known in geologic nomenclature, as the Jurassic period.

The time when these deposits occurred is a matter of pure speculation, and may as well be supposed to have taken place five hundred thousand years ago, as at any period more or less remote. As has been before remarked, had these materials been liable to change, it is only reasonable to suppose that such change would have occurred during the ages that they remained unappropriated to the use of man; experience teaches that they are not subject to those changes which belong to most of the artificial products used in painting.

Hence the value of these native pigments. Economically considered, they are undoubtedly the most valuable of all the paints, where primary or prismatic colors are not absolutely required. The only change they are liable to, is a change of place. They may be, and are of course, wasted by the slow disintegration of the coating which they form with the oil, but in color (when unmixed with white) they are inflexibly permanent, and stand exposure to the sunlight without fading or bleaching in the slightest degree. Nor are they affected by the action of acids and gases, as are most of the artificial paints.

Now that the day of white and light tints is passing away, and a better taste in decorative ornamentation is about to prevail, it becomes all those engaged in the business of painting, to consider to what extent these natural pigments may be made to take the place of the artificial compounds, which have heretofore been considered indispensable, and for which it has been supposed impossible to find substitutes.

It must be remembered that the native pigments are in inexhaustible supply, that they are of almost universal distribution, and that they are not known to possess any value except for the purposes of painting. Nor are the production and preparation of them supposed to affect the health of the workmen engaged in it, unfavorably. So far, therefore, as they can be substituted for those paints the production of which lessens the stock of useful metals, the use of them adds directly to the wealth of the country and of the world. Their application is strongly recommended on the ground of "true economy in the use of paints," whenever they can be made to take the place of the more expensive metallic substances.

CHAPTER V.

TIN ROOFS.

"*A stitch in time saves nine*," is a somewhat trite saying, but nevertheless well worthy of consideration; and in nothing connected with building has it more significance than in the matter of *Tin Roofs*.

For a *flat* roof, tin is, beyond question, the most economical covering that can be applied. If not *neglected*, it is absolutely indestructible by external influences, and will last a hundred years in as good condition as when first laid on, *if kept well painted.* Yet there are to-day, in the city of New York, thousands of roofs undergoing the process of slow corrosion and decay, because of the want of a little timely attention. The comfort of the household, and safety of the property, depend in a great measure on the quality and condition of the roof; yet there are hundreds of thousands of dollars wasted every year by the most inexcusable negligence in this matter. Many owners of valuable houses never visit the roofs, and until admonished by the appearance of stained ceilings and discolored walls, pay no attention to this important subject. The renewing of a tin roof is attended with a considerable outlay of money, and no small amount of inconvenience and trouble. A rainstorm during the process may involve the ruin of hundreds of dollars' worth of expensive and cherished household goods. To avoid this, in many cases, some nostrum-vender who advertises to "*cure* leaky roofs for a small consideration," is allowed to cover the neglected housetop with a coating of tar and sand, *warranted* to remain tight for five years. This temporary expedient, however, like most temporizing, proves a costly experiment, and time soon shows the second state of that roof to be worse than the first; for such neglect there is but one remedy, repentance, a new roof-covering, and a promise of better attention in the future. *Tin on a house-top* should be well *painted once in four years.*

For roofs, *light cool colors* are preferable, because they reflect the warm rays of light and thereby lessen the expansion and contraction of the metal, and the shrinking of the boards underneath, and so lessen the liability of the tin to crack in the seams. The temperature of attic rooms in summer will be materially lower if the roof be painted with a light rather than with a dark color.

The writer has learned, from long experience, that the finest French Ochre is the most economical pigment that can be used for that purpose. If, as is sometimes the case in country-houses, where the roof is a conspicuous object in the architecture of the building, a dark color be indispensable, the use of pure Venetian Red, darkened with Lamp Black, is recommended as the most durable and economical. If, by some process, the oil used in roof-painting could be prevented from becoming hard and brittle, it would be a great gain.

The poorest oil-paint, however, is better than neglect; and the best economy consists in keeping tin entirely and thoroughly protected from the corroding influence of dampness. Old paint which has become "fatty" from exposure to the atmosphere, is better than new for roof-painting. Not a drop of turpentine should be used for such work.

CHAPTER VI.

CHEMISTRY IN THE PRODUCTION OF PAINTS.

To an intelligent comprehension of the nature and properties of the materials used in painting, the complex substances of which most of them are composed, of the changes which they undergo when exposed to the influence of certain gases, of the sun's rays, of atmospheric action, etc., a knowledge, to a greater or less degree of the science of chemistry would seem to be indispensable.

Chemistry may be defined as that science which seeks a rational explanation of all the operations of the material world. This it would accomplish by a thorough knowledge of the forces of elementary substances, of the laws which govern these elements when they are permitted to enter into combination—by reducing all natural compounds to their ultimate constituents—by recombining them to ascertain their mutual relations—and to discover all the possible combinations and forms of matter which have not been worked out in Nature's laboratory.

The discoveries of modern chemists, sufficient already to bewilder ordinary minds, are —the professors of that noble science assure us—as nothing to the revelations which a later day shall bring forth. If, to-day, as its professors claim, the science be in its infancy, what may we not anticipate from its maturity?

The boast of Fairy Puck, to "put a girdle round about the earth in forty minutes," is on the threshold of realization. The lamp of Aladdin is no longer, only a fiction to relieve the monotony of "Arabian Nights." The Genius, locked up in the casket which the fisherman drew out of the depths of the sea, is to-day in the control of the chemist, and is set free or imprisoned at his will. The "seven-league boots" may be put away in the lumber-room, they have already ceased to excite the wonder of listening childhood, and dust and ashes have caused transformations a thousand times more wonderful than the coach and horses and fine dresses of Cinderella.

How little do we realize the fact, which chemical discovery has revealed to us, that there is within us, and around us, an element of the presence of which we are not conscious; a substance so unsubstantial, that its existence even was not known until the eighteenth century!—without palpable form, or smell, or taste, but which, nevertheless, plays the most important part among the forces which control our world.

This spirit, is the breath of our nostrils and the life of our blood, yet a consuming fire which sooner or later will cause us to "wither as the grass, and fade as the flower." Nor will it leave us at the portal of the tomb. There it will enter with us, and continue the work which it commenced on this side the dark valley, until we become in reality the dust of which we were created.

The word gas, or ghost, was, in the days of alchemy, applied to certain substances, from their supposed connection with the spirit-world.

The discovery of oxygen gas, in England, by Doctor Priestley, in the latter part of the eighteenth century, was one of the most important discoveries, so far as regards the material well-being of mankind, that the world has ever witnessed.

Oxygen is a transparent, inodorous, tasteless, colorless substance, about one-tenth heavier than the air, and forming about one-fifth of its bulk. Mixed with nitrogen, it forms the atmosphere which surrounds us, and in which we move and have our being. With hydrogen it forms water, and with carbon, carbonic acid. This latter gas is that substance which gives to soda-water and other effervescing drinks the lively, pungent flavor which is so much liked.

The scope of this work does not comprehend the teaching of the science of chemistry, and the only object in introducing oxygen is the fact that, without some conception of the nature of this wonderful agent, in the production of paints, no intelligent idea of their composition and properties and mode of production is possible.

Oxygen has a wonderful affinity for most all known substances, and particularly so for the metals. So great is the affinity in some instances, that certain metals can be preserved only by immersing them in naphtha, which liquor contains no oxygen.

Molten lead oxidizes instantly on exposure to the atmosphere, but the coating of oxide serves to protect it from any further action of the gas; if this coating be removed, however, another coating is immediately formed, and this may be kept up until the metal shall have lost its metallic character. The most familiar example of this operation is the rusting of iron. This metal, on exposure to the atmosphere (particularly an atmosphere charged with much moisture), becomes at once covered with a coating of oxide of iron. All housekeepers are familiar with this substance, unpleasantly so at times, in the operations of the laundry.

To the presence of this oxide, the ochres or earth-paints owe their colors—they being simply earthy substances, mainly silica (which is of itself more than one-half oxygen by weight)—colored by water impregnated with iron rust. Oxygen with lead, in varying proportions, gives us white lead, red lead, litharge, and with the addition of chromic acid, chrome yellow and American vermilion. From oxygen with zinc, we have the beautiful white pigment, oxide of zinc. With iron and potash, oxygen affords the beautiful color known as Prussian blue. From the oxides of copper we obtain verdigris, and the brilliant pigment known as Paris green. With cobalt, we have the fine blue of smalts; and with chromium, the greens and yellows known as chrome colors. "Yet this simple substance, which makes up more than one-half of the ponderable matter of the earth, is without color, taste, or smell, and the eye of man has never beheld it."

How few realize the fact that the white-lead paint which beautifies and preserves our dwellings, is the well-known and familiar metal transformed to its present unrecognizable condition by the action of oxygen! that to this invisible agent we owe most of the colors and varied tints which, by the never-ending variety of their harmonious blendings and contrasts, afford us such exquisite enjoyment and gratification!

Nature, bounteous in colors, proffers us in the vaulted arch above, in the blue expanse of waters, in the flowers which bloom along the land, an exhaustless source of innocent delight! Shall we churlishly refuse the proffered joy, shut our eyes to all the forms of beauty spread out around us, and trample, brute-like, on the flowers which spring up in our path? Let us rather accept and admire, with hearts full of gratitude toward the glorious Giver of all these good and perfect gifts!

CHAPTER VII.

PREPARATION OF COLORS.

The art of preparing colors for the use of the painter, is one which requires a thorough practical knowledge of the nature and composition of the various pigments, and skill in the selection of the same, as well as an entire familiarity with the different degrees of fineness which the colors may require to fit them for the purposes to which they may be applied. Some paints lose their brilliancy and beauty by too much crushing and grinding, and become dull, pale, and comparatively worthless, while others require grinding to the last degree of fineness, to develop the color which is in them. Notwithstanding these facts, which are known to every painter who has been properly educated in his profession, the business of preparing colors for his use is to a great extent in the hands of persons entirely ignorant of the nature of paints, and the requirements of the painter. Active and ever-increasing competition has begotten a strife, not as to who shall produce the best possible paints, but as to who shall put upon the market the worst article which can by any stretch of fancy be called a "ground-color." This evil has, however, like most others, worked out (or is in process of working) its own cure. Experience is teaching the lesson, where it has not already been learned, that "cheap paint," that is, paint made to sell at a low figure by means of extreme adulteration, is "dear at any price." This rule, however, is not of universal application, but is intended to apply to painters mostly, who have the means and knowledge required to avoid the waste of good material. There are many cases when a small quantity of color is required to produce a certain tint, and colors cannot always be obtained in such small quantities as may be desired. In such cases, it would be advisable to buy a cheaper article and consume it all, rather than to buy the best, and suffer a large portion of it to be wasted. It must be borne in mind by the painter that in cheapening paints by the admixture of adulterating materials, the reduction must be made wholly in that portion of the mixture which possesses the coloring property he requires. There can be no corresponding cheapening of *all* the materials. The oil, the labor, and packages, cost as much for the poorest as for the best colors; therefore a color which sells at twenty cents per pound may possess really three times as much intrinsic value as one which sells at one-half that price. There can be no better rule for a painter to adopt than to buy *always the best colors*, and in *packages as large* as the requirements of his trade will justify, with a view to strict economy and the prevention of waste.

CHAPTER VIII.

WHITE PIGMENTS.

The only white pigments used in house painting that are of sufficient importance to notice in this place, are the *Carbonate of Lead* (White Lead) and the *White Oxide of Zinc*. In the detailed description which follows, of the method of producing these two most important articles, the writer has endeavored to avoid, as much as possible, the use of technical terms, and has confined himself to such only as shall set forth in the clearest manner possible, to those who may be unacquainted with scientific signs, the mode of operation. The use of white lead in oil-painting is of very ancient origin, while the use of white oxide of zinc is comparatively of recent date. One of these two, at the present day, forms the staple of all the neutral tints used by painters, and enters more or less into all the shades of the positive colors, such as green, red, blue, yellow, etc. They are more extensively used by themselves, that is, without tinting, than other paints, and are consequently of the first importance. The comparative value of these two materials, the properties they possess to resist the action of the weather, and the many gases to which they are under nearly all circumstances exposed—and, most important of all, their merits or demerits in an economical point of view, open a wide field of discussion, and call into action a vast amount of prejudice. In entering this field, the writer promises to set forth as clearly and impartially as possible what he believes to be the facts in the case. His views are the result of an experience of more than twenty-five years in the business of preparing paints and colors for painters' use, and he has had unusually good opportunities of comparing the opinions of painters from various and widely-separated parts of the country, many of them men of large experience, whose views are entitled to much consideration. White lead, having had for so many years undisputed possession of the field, looked very naturally upon any rival as an upstart—a usurper of its before unquestioned prerogative. The large amount of capital invested in its production, its many good qualities, the repeated failures to find a substitute for it, and its entire respectability, so to speak, caused it to look upon the humbler aspirant for public favor with contempt. That time, however, has passed by; and the question is no longer, whether or not Zinc shall have a share in the public estimation, but whether or not it possesses superior properties as a white pigment to the carbonate of lead.

Keeping in view the fact that painting is done not so much to preserve as to beautify our dwellings, and to make them cleanly and easy to be kept clean, and that whiteness is an indispensable requisite—as clear pure tints cannot be produced without a pure white—the ready conclusion would be, that any white paint which most readily and economically realizes that result would be adopted without question. That white lead possesses a density, opacity, body, and covering property superior to zinc, will not be questioned—white-lead ground, without any admixture of adulterating materials, of course, is meant. To account for this, we need go no further than the fact that, a given weight of white lead in its dry state requires less than half the quantity of oil to wet it that would be necessary to wet the same quantity of zinc. Now, white paint derives, in a great measure, its value from its covering qualities, that is, the property of opacity, its quality of rendering soiled, dirty, stained, discolored wood-work or walls solidly white; of producing a clear, white surface, covering up and rendering invisible whatever may have been before unsightly. That this result may be obtained more certainly with lead than with zinc, there can hardly be a question; but there is a second very important consideration, which is, the comparative durability of the two materials. The painted work inside a house requires constant wiping and washing to keep it clean; hence it follows, other things being equal, that the paint which adheres most tenaciously to the wood, which resists most successfully the constant and repeated washings to which inside work must more or less be exposed, is the most economical and most desirable. Zinc paint is more water-proof than lead; that is, the application of water and soap to the outward surface of a coating of zinc does not impair its durability to the same degree that it does lead paint. The particles of lead do not have any cohesiveness except what the oil gives them; and that cohesiveness being removed by the action of water or the sun's rays, they fall off from the wood. On the contrary, the particles of zinc seem to depend on each other to form a continuous coating; they seem to overlie, to lap on, in such a way as to prevent the water from working around or behind them. All who have taken notice are aware of the fact that outside work, covered with the very best of white-lead paint, becomes in a short time chalky, and the paint rubs off on the hand or clothes when brought in contact with it, especially in sunny exposures. The reason of this is, that the sun, acting with the lead, destroys the water-proof properties of the oil, and the paint becomes a whitewash, liable to be removed by rain and storms. ZINC, from this property of cohesiveness which it possesses, is not so soon affected by the action of the sun and rain. It forms a smoother, harder surface, and, shedding the water more perfectly, resists its action for a greater length of time.

Yet for this very reason zinc is unsuited for use in situations exposed to much dampness, for, though it does not, like white lead, crumble away and fall off particle after particle, it does scale or flake, and falls from the wood in shelly masses, leaving the surface of the work as entirely free from covering as if it had not been painted. This occurs, however, only in situations where it is exposed to much dampness. Where zinc is employed, it is not recommended for a first coating, but white-lead for the first application, and zinc for the succeeding coats, particularly the finishing one. As to the question of comparative expense in the use of these materials, there is not much to be said—possibly there is a slight difference in favor of zinc, but it is inconsiderable.

CHAPTER IX.

WHITE LEAD, ITS MODE OF PRODUCTION, ETC.

Until within the present century, the manufacture of white lead was confined principally to Holland; and what is known as the Dutch process is now the mode of operation in its production in most of the lead-works of Europe and America. As before stated, until within a few years, carbonate of lead was the only white paint in use for painting the woodwork and walls of houses. It preserves its whiteness well when mixed with oil, works smoothly and easily under the brush, and gives a uniform coating to wood, plaster, or stone. Under some of its various names, as Silver White, Flake White, Krems White, or China White, it is the most important pigment on the palette of the artist, and forms, with zinc, the staple in the stock of the house-painter. Although some improvements have been made in the manufacture of this article, it remains the same, in all its essential features, as when first described in print. Hundreds of so-called improvements have been made, and innumerable patents have been issued, for inventions whereby the loss of time consequent upon the production of white lead by the old process was to be avoided, and the cost of manufacture lessened; or, some other oxide of lead was to be substituted for the carbonate. So far none of them have, to any appreciable extent, lessened the demand for white lead, or brought it into disfavor in the slightest degree. Millions of dollars have been wasted in the so-far vain attempt to find a preparation of lead which should take the place of the carbonate, as produced by the Dutch process.

White lead is produced simply by exposing thin sheets or shapes of blue lead to the fumes of vinegar. The metallic lead is melted in iron kettles, and run into moulds or shapes called buckles. These buckles are about the circum ference of small tea-plates, and have the appearance in form somewhat of large, round buckles; the object being to expose as much of the surface of the metal as possible to the action of the vinegar. These buckles are placed in earthen pots (glazed on the inside) of uniform size, along with a quantity of whiskey or molasses vinegar, or other acetic acid. Thus charged, the pots are placed in a bed of spent tan-bark (the refuse of the tan-yard) to the number of 12,000, more or less, according to convenience. The first layer of pots is covered with boards, on which is placed another and thinner layer of tan, and again a layer of pots, and so on, alternate layers of tan and pots, until the stack, as it is called, is completed. On the top of all is placed a thick layer of tan, and the process of converting the metal into white lead may be said to have commenced. In a longer or shorter time, ac cording to circumstances, the tan generates sufficient heat to vaporize the acid, which, coming in contact with the metal, changes the same, by a mysterious chemical process, into a white, brittle substance which, with crushing and grinding, becomes the beautiful white pigment with which all are familiar under the name of white lead. The process of disintegration and conversion goes on for many days, and at the end of eight or ten weeks, more or less, the stack is ready to be taken down. On uncovering the pots, they will be found to contain no acid, and the buckles will be found to have increased materially in thickness and bulk and weight. In that unsightly and apparently inert mass of tan and boards, has been going on, silently and secretly, hour after hour, day after day, and week after week, during the lone watches of the night and the bright glare of noonday, one of the most beautiful and interesting processes of nature. The acid, at first cold and inactive, warmed into life by the self-generated heat of the surrounding mass, has attacked the tough and ductile metal, destroying its metallic structure, form ing a new combination into which it enters as one of the component parts, adding weight and bulk to the already heavy substance, and bringing forth a material which to the eye offers no sign of the secret of its birth. During the process, the tan will have lost its power of generating heat, the acid will have been resolved into its original elements, and the buckles, with their added weight, remain to repay the cost of expended labor and material. These buckles, when taken from the pots, are found to be encrusted, to a greater or less extent (in some cases perfect corrosion has taken place), with a white, brittle coating, amounting say to two-thirds or three-fourths by weight of the buckles when first placed in the pots. This crustation is removed by pounding, in a machine prepared for the purpose, and that portion of blue lead which shall remain is returned to the melting-pots to be again cast into buckles and again submitted to the action of vinegar and heat. The crust, which is now the carbonate of lead, composed of about ninety parts of metal with ten parts of carbonic acid, is thoroughly washed to free it from stains arising from whatever cause, and then crushed and ground in water between heavy mill-stones, into a fine, pasty mass, which is conveyed to a stack or series of steam-tight, hollow pans placed one above the other, the upper surfaces of which are composed of sheets of copper, riveted together to form continuous plates. Into the hollow of these pans, the exhausted steam from the engine is introduced, and the white lead is thoroughly dried. It has now become the dry white lead of commerce, and is ready to be made into paint, simply by mixing with linseed-oil in the proportion of about nine pounds of oil to one hundred pounds of lead, and again grinding in heavy stone mills. The production for the United States for the year 1867 is estimated at about eighteen thousand tons; more than half of which was produced by the different manufactories in the city of Brooklyn. The objections to the use of white lead, as a paint, are worthy of consideration, though not by any means so formidable as most persons suppose. The main objection is the poisonous property of the article, and its consequent deleterious effect upon the health. The second, its liability to become discolored by the action of certain gases which are common in and about every dwelling. The first objection was, in former times, of great importance, but now has lost nearly, if not wholly, its force. In those times the rudimentary part of the education of a painter's apprentice in the mysteries of the craft was the mixing of dry white lead with oil in a tub or keg, and grinding the same in a mill with hand-power. This work was usually performed during the winter months, in close, warm rooms, and more or less of the particles of dry lead found their way into the system by inhalation. The effect was seen in the fair complexions and decayed teeth of most of those who followed the trade, and not a few cases of painter's colic occurred, some of which proved fatal. In these times we have changed all that. Now, steam does the unwholesome drudgery, and gives to the painter's apprentice better occupation for his winter hours, than the rudimentary crank-work which, to say the best of it, was not a highly-intellectual occupation, nor one calculated to lead the soul to longings after the ideal. Now, the white lead comes to the hands of the workman locked up, so to speak, in indissoluble bonds, every particle of it enclosed and encased with a water-proof substance, and no more deleterious to health than would be the same quantity of flour-paste. It has been pronounced by learned and scientific men, doctors and professors, to be unwholesome to sleep in freshly-painted apartments, or to inhale the air of a room newly painted. The ground for such a theory is, of course, the supposition that there are, floating in the atmosphere, particles of white lead in sufficient quantity to injure the health, the same finding their way into the system by inhalation or absorption. In the opinion of the writer, it would take as long to poison a man with the particles of white lead which float in the atmosphere of a freshly-painted house, as to cause an attack of gravel by inhaling the particles of a grind-stone which fly off with the water that evaporates from its surface. Indeed, it is contended that not the minutest particle of white lead passes off from the surface of newly-painted wood-work during the chemical operation of the drying of the paint. To say that people are made sick or nauseated by the smell of fresh paint, is no more an argument in favor of the theory of its being poisonous, than that the odor of onions, which is disgusting to many, is proof of the unwholesomeness of that pungent and highly-nutritious vegetable.

White lead is not recommended for iron-work, when the object is to preserve the metal from the corrosive action of oxygen. It may be truly said that there is no pigment in common use (the copper greens excepted) which does not afford a better protection than pure white lead. Most oil paints are simple mechanical mixtures, and the pigments are not supposed to exert any chemical action on the oil in which they are mixed; but the oxygen in white lead is supposed to combine with part of the oil, and thereby form true plaster or metallic soap. This chemical change may account for the well-known fact, that pure white lead is the least durable of any known pigment. When a white surface is indispensable, zinc is far preferable to lead, for painting iron.

CHAPTER X.

WHITE OXIDE OF ZINC.

This pigment, which ranks next in importance to white lead in the list of paints, consists of thirty-two parts of the metal zinc, and eight parts of oxygen. In its dry state, it is a beautiful white, soft, feathery substance, and has long been known and used for medicinal purposes, under the name of Flowers of Zinc. It mixes readily with oil, but does not work so freely under the brush as white lead, and requires rather more skill in its manipulation, to produce a smooth and even surface. It is entirely free from objections in a sanitary point of view, and is not known to affect deleteriously the health of the workmen engaged in its production, in the slightest degree. This pigment is produced by reducing the ores of zinc in oven-shaped furnaces having perforated cast-iron floors, and openings in the tops for the escape of the zinc and the gases of combustion. A fire of anthracite coal is made all over the floor of the furnace, and a blast of cold air is driven through the same. The ores, crushed to the size of coarse sand, and mixed with fine coal, are spread on the fire, and when raised to 2,000 degrees Fahrenheit, are deoxidized—the oxygen of the ore uniting with the coal, forming carbonic acid gas—the zinc rising as a metallic vapor. The vapor and gases are sucked from the furnace, and conveyed through iron pipes to a large room into which they are driven, and out of which the gases escape. This room is filled with large, stout bags, suspended open-mouthed to catch the zinc, which, in its passage from the furnace to the bags, goes through chambers into which air is admitted. In its vaporous form it unites with the oxygen of the atmosphere, forming the light, flaky substance known as Flowers of Zinc. The oxide at this stage is extremely light, thirty or forty pounds of the same being sufficient to fill a barrel. It is then compressed to about one-fourth of its former bulk, and packed in barrels of 200 pounds or casks of 400 pounds, and sold to manufacturers, whose business it is to prepare the same by mixing and grinding in oil for the use of the painter.

White zinc was formerly largely, and is now to some extent, imported from France and Belgium. The rapid improvement in the manufacture of it in this country has, however, to a great extent, driven the foreign zinc from the market. There are several establishments in this country for the manufacture of white oxide of zinc, the principal ones being the New Jersey Zinc Company, at Newark, N. J., who manufacture principally from the ore known as red oxide; the Lehigh Zinc Company, at Bethlehem, Pa., who use the ores known as carbonates and silicates; and the Passaic Mining and Manufacturing Company, who use the red oxides, as also the carbonates and silicates. The total production of zinc paint by the different manufactories in the United States, during the past year (1867), was seven thousand five hundred tons.

CHAPTER XI.

THEORY OF COLOR.

When the material objects composing a landscape or other diversified view are photographed on the retina of the eye, the mind becomes conscious of certain impressions. These impressions, when analyzed, are found to comprise the ideas of height, breadth, depth, form, distance, and color. All these, except the latter, are facts capable of mathematical demonstration, and exist, so far as the eye alone teaches, independent of the direct action of any of the invisible forces of nature. Color, on the contrary, which in many instances produces the most vivid impression of all, is not in any sense an attribute of these visible forms. It does not belong to them, and is no more a part of them than the sensation which it produces. All the attributes of substantial objects, all the material forms which are revealed to the eye, may be made comprehensible to the mind of one deprived of the sense of sight; but the mind of a blind man cannot grasp the idea of color. The fatigue consequent upon ascending a lofty tower, may teach him, experimentally, of the fact of height; the exercise of limb necessary to reach a remote point, tells him of the fact of distance; the sense of touch, in his case, exquisitely acute from constant use, will reveal to him forms the most delicate and intricate; but of the sensation of color, his darkened mind can have no conception—simply because, when there is not a perfect visual organ, there can be no intelligent comprehension of that sensation which for convenience we call color. Nor does it follow even when, for other purposes, the organ of vision is perfect, that the sensation of color is produced upon the mind. Color-blindness is by no means uncommon, and some facts connected with that peculiar affection will be given in succeeding pages.

Color is an attribute of light, and in the absence of light all objects are black! That the color which seems to belong to any material substance is not inherent in that substance, or inseparable from it, is proved by the fact that we can give to a body, any desired color, by exposing it to light of that peculiar hue. For example; the light which passes through a stained-glass window gives to any substance on which it may fall the color of the light which is transmitted; and so long as the light continues the color remains; as the light fades, the color grows more indistinct, and in the absence of light will have ceased to exist, not only in the particular spot, but on all surrounding objects.

A direct ray from the sun, reaching the brain through the optic nerve, causes a sensation which is signified by the term *white.* That ray, however, is not simple, but a compound structure, and is capable, under certain modifications, of causing a variety of sensations which collectively we call colors. When a ray of light from the sun is passed through a three-sided piece of polished glass, it is refracted; that is, broken, separated. This broken ray, falling on a white surface, presents to the eye an image composed of many bands of colored light. The cause which produces these sensations must be inherent in this white light, because the medium through which it has passed, and which has broken it, is colorless of itself, and cannot impart color to the light in its passage.

A closer examination of this split or broken ray, shows us its true composition. At the base of this image we find RED. This modulates into red-orange, orange, yellow-orange, which is succeeded by yellow, the second color in the spectrum—the intermediate hues being the result of the mingling of the two colors. *Yellow* is succeeded by yellow-green, green, blue-green, and *blue;* then comes, completing the circle, blue-purple,

purple or violet, red-purple, and again red. Shut out the ray of light, and we have black, which is the absence of all color; remove the prism and admit the ray, and we have white, unbroken light, which is made up of the three colors, red, yellow, and blue.

The true theory of color (or more properly, perhaps, the theory generally accepted by the scientific to-day) is commonly hard to be understood, and the objections to it take this shape: "Do you mean that the many colors, and hues, and tints, which we see around us, have no existence but in the brain, and are as unsubstantial as the emotions we experience in beholding them—mere impressions, which cease to exist, except in the memory, when we close our eyes to them?"

The hues of the rainbow are as substantial as the colors of the most gorgeous purple stuffs which the eye ever beheld! the same law operates to produce them all. Little globules of water, under certain circumstances, possess the power or property of breaking the sunlight into its component parts. When, under such circumstances, these refracted rays fall upon the eye, and enter the brain, the image photographed there is a bow or arc of greater or less extent, composed of bands or stripes of colors and hues in regular succession, always in the same order, differing only in intensity. While we gaze, the image fades; from some cause—either the declining sun or an intervening cloud—the beautiful bow has ceased to exist; yet the colors in that rainbow were as real, as substantial, as those found on the painted walls of Herculaneum, or in the chambers of the Egyptian pyramids, which have retained their brilliancy through all the changes of twenty, thirty, or forty centuries. Similar causes will again produce like effects. When the sun, the eye, and the rain-drops shall again find themselves in the same relative positions, the colored bow will reappear, and the colors would remain fixed, permanent, supposing the resulting causes could remain the same.

All visible substances possess the property of refracting, reflecting, transmitting, or absorbing the rays of light which fall upon them, and the results are colors, hues, tones, tints, and shades. Some substances absorb all the colored rays, others reflect them all. (In a strictly technical sense, this is not so, but the language is sufficiently correct for practical purposes.) In the one case, we have black, which is the absence of all color; in the other white, which is the presence of all. Between these extremes we have the primary colors, red, blue, and yellow, and all their deeper and lighter tones.

By *mixing* these colors in varying proportions, we obtain the various *hues*. By mixing the colors with black, we shade them, and by mixing with white, we tint them. Combinations of colors with each other, and with white and black, where no particular color predominates, are called neutral tints. By mixing blue and red, we obtain violet, and by varying the proportions, all the hues between red and blue. By mixing blue with yellow, we produce green, and all the hues of blue and yellow-green as the blue or yellow predominates. By mixing red with yellow, we produce orange, and all the hues of red and yellow-orange.

When a substance or form of matter possesses the property of absorbing or extinguishing those primary colors which are called blue and yellow, and reflecting the third, we signify the sensation, which is produced on the brain by looking at this substance, as red.

When red and blue are absorbed, a different sensation is the result, and yellow is the name we use to distinguish that; and so through the never-ending variety of colors, hues, tints, and shades.

The alphabet of color has only three letters; but so wonderful are these in their possible transpositions and combinations, that the skill of man shall never exhaust them. The pencil of the artist shall write new stories from age to age, and new combinations shall ever afford us fresh delight.

CHAPTER XII.

COLOR-BLINDNESS.

To say that one has "*no ear for music*," is a common and properly significant expression, and the want of it is considered not only a misfortune, but is frequently made a subject of reproach. Its absence is popularly supposed to indicate the presence of certain qualities which render a man unworthy the confidence of his fellows. To say that one has "*no eye for color*," is equally proper and significant; but, as yet among our own people, such a misfortune is not supposed to furnish good ground for impugning a man's sincerity, or to unfit him for the occupation of any position of trust or confidence. Yet it would be difficult to give a plausible reason why "his affections" should be "dark as Erebus" in the one case, and not in the other.

The faculty to discriminate color, exists in different individuals, in all the various degrees of development. The want of *sensibility to color-impressions* is generally supposed to be peculiar, and the affection in marked cases is termed "color-blindness;" but, in the opinion of the writer, it will be difficult, if not impossible, to draw the line to determine who are and who are not color-blind. Doctor Wilson, of Edinburgh, in 1855, published a work on color-blindness, wherein he arranges the different forms or degrees of dulness to color-impressions, as manifested by different individuals.

The first form, which is common among males, particularly of the educated classes, is shown in the inability to distinguish certain tones of browns, from certain tones of green; say a dull green from a dingy brown; the second, an inability to distinguish certain primary colors, as red from green; the third, an inability to distinguish any color, as such; the person affected in the latter degree, seeing only white and black, lights and shades. In the first degree, this affection is, among males, perhaps the rule rather than the exception, and is owing, probably, to a lack of education in the discrimination of colors. In support of this hypothesis, the fact may be mentioned that deaf mutes possess this power of discrimination to a high degree. Being deprived of the use of those most important faculties, hearing and speech, the organs remaining to them are called into action to an extent quite impossible with those who possess all the faculties unimpaired. Hence such persons become, unconsciously, highly educated in the discrimination of tones, hues, and shades.

An instance illustrative of this fact fell under the observation of the writer, in the person of a deaf mute, a girl, the offspring of a married couple who were related to each other in the degree of first cousins. This child was of rare personal beauty, both of face and figure, and the senses remaining to her were quickened to a degree quite uncommon with children generally. In the room occupied by the writer was a large piece of Berlin worsted work, and a basket containing the remnants of the colored yarns, portions of which had been used in the production of the work. The child was a frequent visitor, and it was a source of great interest and amusement to observe how unerringly she would select from the basket, the yarn corresponding to any designated hue on the work. No matter how slight the difference in shades, she never made a mistake in the selection. Dr. Wilson found that the majority of pupils in the chemical class at the veterinary college in Edinburgh, declined to name any colors beyond red, blue, green, yellow, and brown; while they failed entirely in attempting to arrange nearly related hues of yarns, or those of varying shades of the same hue, and that pink and other pale colors, as pale yellow, blue, and green, were often confounded. In the second degree, in the less marked cases, red and green, and these with olive and brown, failed to be distinguished.

It is by no means uncommon to find persons unable to distinguish the red fruit on an apple-tree from the green of its leaves. Three brothers are mentioned by Dr. Wilson, who mistook red for green, orange for grass-green, yellow for light green. In the third degree, cases of which are rare, all colors are recognized only as giving certain degrees of light and shade. Instances are related of tailors, who matched black cloth with red thread, and scarlet livery with green strings; of a physician who never found a case of scarlet fever; of a gentleman who condoled with a lady supposing her in weeds, when she was dressed in a vivid green; of a Quaker who purchased a bottle-green coat for himself, and a scarlet merino gown for his wife; and of a school-girl who attempted to arrange the colors in her drawing by the sense of taste.

The causes of color-blindness are difficult to trace: it occurs equally with light and dark eyes, and is confined mostly to the educated classes, the female sex, however, furnishing but few examples. Among the savage tribes no case has ever been known.

These instances of color-blindness are given, to meet the objection which will be made to the theory that color is a sensation, and not a substance. It must be borne in mind that, for all other practical purposes, the visual organs in those persons affected by color-blindness, were as perfect as are those of ordinary individuals. The defect is somewhere between the eye and the brain; either the eye is incapable of transmitting the colored rays of light, or the brain is incapable of experiencing the sensation of color: arguing from general principles, we should say that the defect is in the optic nerve, and is simply a want of sensibility to certain impressions, bearing the same relation to the waves of light as the hearing in those persons who are said to have no ear for music, does to the waves of sound. It is well known that those who are insensible to musical sounds, who cannot distinguish the tones in the musical scale, are for other purposes sufficiently acute in the sense of hearing; but be the cause what it may, there will be no difficulty in arriving at the conclusion that one, so affected, should not adopt the calling or profession of painting, or any other trade wherein a nice sense of discrimination between colors and shades is required.

CHAPTER XIII.

BLACK PIGMENTS.

Lamp Black, Drop Black, Ivory Black, Bone Black, Frankfort Black are the names applied to the simple substance which affords all the blacks used in painting, and in the manufacture of printers' ink, viz., Carbon. Lamp black, the most important and useful form of carbon to be considered here, is produced from the article known in trade as common rosin, or other bituminous substances. The finer kinds are made from rosin, and the common kinds from coal or gas tar.

All resinous, oily, fatty substances produce lamp black in the process of burning, it being simply the soot resulting from highly-combustible bodies as they are imperfectly consumed. Every smoking lamp is a lamp-black manufactory in miniature. Being nearly pure carbon, it is one of the most unchangeable substances known, absolutely indestructible under all ordinary influences. Acids, alkalies, and gases, which powerfully and rapidly affect most other forms of matter, have generally no effect on this.

The most powerful sunlight cannot bleach, or destroy, or change its form or character. Through all the changes of times and seasons, the winter's cold and summer's heat, it remains the same. Except in combination with oxygen, it is unchanged by heat, and, in some of its forms, a furnace-fire which will melt steel as wax, causing it to flow like water, does not produce the slightest perceptible effect on this simple substance.

A very good idea of its permanent character, when used as a paint, may be had by observing the old sign-boards at toll-gates and toll-bridges. Exposure for many years to sunshine and storms has, in most cases, not only removed the surrounding white-lead paint which originally covered the wood, and on which the letters were traced, but the wood itself will have yielded to atmospheric influences, and fallen away by slow disintegration, leaving the characters which signify the directions, rates of toll, etc., raised above the surrounding surface, like the letters used by blind persons in learning to read. The carbon used in painting the letters has remained through all, the same, bidding defiance to the tooth of Time himself. This property is shown also in a more striking degree perhaps, by the writings found at Herculaneum, which have retained their original blackness for more than two thousand years. In remote former periods this property was known and appreciated, and the ancients seem to have availed themselves of it on all important occasions.

It would be a great mistake, however, to suppose that all the black paint sold and used is pure carbon; on the contrary, all that used in ship-painting, and known as common black paint, is very extensively cheapened by adulteration. So far, indeed, is this process carried, that common black paint is mostly composed of some cheap earthy substance, blackened by the addition of a small percentage of lamp black. The extensive use of this worthless material affords another instance of the want of economy manifested in painting. The actual first cost of painting a vessel with pure carbon black is much less than painting with the cheap adulterated material in common use, to say nothing of the saving in labor, which is a most important consideration. While, in the one case, the paint retains its blackness, and adheres tenaciously to the wood, in the other it turns gray after a brief exposure, and needs frequent renewals.

The test of the purity of black paint is its weight in proportion to its bulk: a can or keg which will contain twenty-five pounds of common black paint will contain but ten pounds of pure carbon black. One pound of pure black will cover as much surface as three pounds of common black, at proportionately much less expenditure of labor. Notwithstanding these facts, it would be difficult, if not impossible, to obtain in any chandlery in the city of New York, where ship-paints are sold, a keg of pure black paint.

In ship-painting, as in house-painting, good results can be produced only by the use of good material. *The best are always the cheapest.*

The article next in importance is ivory or bone black (animal charcoal), known also as drop black, and patent black. This is made by first calcining bones or ivory chips and turnings, in a close retort, and afterward powdering the charcoal, and grinding it in water between heavy millstones. To render it more entirely black, and give opacity, a portion of prussiate of iron is added. After being thoroughly dried in the form of drops or cakes, it is again powdered, and again ground in oil. This black is used mostly in coach and carriage work.

Frankfort Black is produced by calcining vine branches and twigs and other lees of the vinegar-vats in Germany. It is of no particular importance to the house-painter, but is used to some extent in painting in water-colors. It has a peculiar blue tint.

CHAPTER XIV.

GREEN PIGMENTS.

Greens, so abundant in the vegetable kingdom, are rare in the mineral world—copper being the only metal, which, in its combinations, affords the various shades of green in common use. All greens used in house-painting are either copper greens or chrome greens. Chrome green (when moderately pure) possesses a dense body, or covering property, and is classed among what are called body colors.

These greens (chromes) are not permanent, being a combination of blue and yellow, which colors are not affected in like degree by the action of light. The copper greens are transparent, by far the most durable, and retain their brilliancy much longer when exposed to the action of the sun's rays. Previous to the introduction of the chrome colors, the only green pigment in common use was verdigris—French, *vert-de-gris.*

VERDIGRIS (*a union of oxide of copper and acetic acid*) is produced by exposing small sheets of copper to the action of vinegar, in the following manner: The refuse of grapes, after the extraction of the juice, is placed in earthen vessels, which are covered with lids, and surrounded with straw mats. The materials soon become heated, and fermentation, beginning at the bottom, rises till it permeates the whole mass. At the end of two or three days, the fermenting materials are removed to other vessels, in order to check the process, lest putrefaction should ensue. The copper plates are prepared by rubbing them with cloth dipped in a solution of verdigris, and then set aside to dry. When the materials are all found to be in proper condition, the plates are laid on a horizontal wooden grating in the middle of the vat, on the floor of which is placed a pan of burning charcoal, which heats them to a certain degree. In this state they are put into earthen vessels, with alternate layers of the fermenting grape-lees, the vessels are covered with straw mats and left at rest. At the end of ten or fifteen days, they are opened, to ascertain if the operation be completed. If detached glossy crystals be perceived on the surface, the grapes are thrown away, and the plates are placed upright in the cellar, one against the other; at the end of two or three days, they are moistened by being dipped in water, which is continued at intervals from time to time. This treatment causes the plates to swell, to become green, and be covered with a layer of verdigris. This is scraped off, pressed in paper sacks, dried by exposure to the sun and air, and becomes the verdigris of commerce.

Distilled Verdigris, erroneously so called, is made by dissolving one part of verdigris in two of distilled vinegar. The solution is then evaporated and crystallized. This article was formerly used in the paint-shop to some extent, but is hardly known now to the majority of painters.

Paris Green, or, more properly, Scheele's Green (*arsenite of copper*), is a late discovery, and was first manufactured by the chemist whose name it bears. It is known in England as Emerald Green. It consists of about twenty-eight parts oxide of copper and seventy-two parts arsenic, is a highly-poisonous substance, some persons being peculiarly obnoxious to its poisonous influence. Fatal accidents have resulted from its careless use. A few years since, the quantity of this pigment used in this country was enormous, but of late the chrome greens have taken its place. It is highly transparent, works badly under the brush, and, as painters express it, "covers badly;" consequently, most of the trade prefer not to use it. In contrast with it, however, so brilliant is this color, all other greens become dingy browns, and the eye refuses to recognize any other pigment as green, for some seconds after looking at this dazzling tint.

Its mode of production is as follows: First, an arsenite of soda is formed, by adding arsenic to carbonate of soda dissolved in boiling water; next sulphate of copper (blue vitriol) is dissolved in water: both solutions are filtered, and the first is poured progressively into the second so long as it produces a rich, grass-green precipitate; this, being thrown upon a filter-cloth, and cleansed by washing away all particles soluble in water, is then dried and pulverized.

Chrome Green.—This well-known and serviceable pigment is another of the products of the metal chromium, in combination with prussiate of iron. Chrome-ore is a union of the oxides of chromium and iron, and is of rare occurrence. It is found in considerable quantities in this country, in Maryland, near Baltimore; the chief application of this ore is in the production of chromic acid (bichromate of potash), which is extensively used in dyeing and calico-printing, and in the production of the paints known as chrome colors. Chromic acid, literally color acid, derives its name (the Greek original signifies color or to color) from the property it possesses of throwing down a colored precipitate, when added to the saline solutions of certain metals.

The pigment known as chrome green is made by mixing together chromate of lead (chrome yellow) and prussiate of iron (Prussian blue). This product is combined with an earthy base, either sulphate of baryta or silica, in proportions to suit the market as to price. It is sold under various names, as chrome green, Brunswick green, Imperial green, Hampden green, Mount Vernon green, Persian green, Magnesia green, etc., etc. These paints differ only in the quantities of coloring matter which they contain, and in the different tones of color. Under whatever name, they are simply earthy substances, colored with a mixture of blue and yellow.

The tones and tints of greens are distinguished by the following names; that is, the names given are those by which the greater majority of people, speaking the English tongue, will best comprehend the idea intended to be conveyed: grass green, known among pigments as Emerald or Paris green (this color best represents pure green; the others are mostly shades and tints or broken colors, including a mixture of white, or black, or red, or perhaps of all these); verditer, or verdigris green (a blue green, changing when used in oil to a bronze hue), pea green, leek green, sea green, parrot green, apple green, tea green, olive green, blue green, yellow green, rifle green, bronze green, sage green.

CHAPTER XV.

BLUE PIGMENTS.

Nature, so prodigal in the dispensation of green tints throughout the vegetable world, has been correspondingly chary in the diffusion of pure, unmixed blue. Among the wild flowers of the woods and fields, and the thousands of cultivated exotics in gardens and green-houses, one may look almost in vain for a perfectly pure blue tint. The slightest admixture of yellow causes a green tinge, and a trace of red produces a purple or violet color.

The only blues used in house-painting are Prussian blue, cobalt blue, and imitation of ultra-marine.

True Ultra-Marine.—This beautiful blue (which formerly sold in London at twice its weight in gold) is of Nature's own production, and has never been equalled by chemical skill. It is the purest in tint of all the known blue pigments, being nearly free from any tinge of purple or green, and is also one of the most permanent in color. It is produced from lazulite, a precious stone found principally in Persia and Silesia. To the house-painter it is of no importance, except as a matter of curiosity.

Imitation Ultra-Marine is the product of chemical skill, and was discovered by a French chemist, Guimet. It is said to be manufactured from precisely the same materials as are found on analyzing the lapis lazuli, viz.: silex, soda, alumina, and sulphur; and so nearly does this artificial product resemble the genuine, that good judges of color have failed, at first sight, to distinguish the real from the factitious. Its manufacture is confined mostly to Germany. It is largely used in the coloring of paper-hangings, and on interior decoration.

Prussian Blue (*prussiate of iron or ferro-cyanodide of iron*) is a deep-toned, brilliant, transparent color, bordering slightly on the green tinge. It possesses wonderful coloring property, and is used extensively by the artist on miniature draperies. It serves admirably to represent blue velvet; and, mixed with carmine, all the varieties of purple, violet, maroon, and cherry-colored velvets are obtained. It is little used by the house-painter in its pure state, but for producing with white the different tints of lighter blues.

Prussian blue is a chemical compound of iron and the gaseous substance known as cyanogen. It is produced by boiling together prussiate of potash, green sulphate of iron (copperas), and nitric and sulphuric acids in certain proportions. The precipitate is washed, filtered, pressed, and dried. This is known as pure blue, China, or Chinese blue. The cheaper kinds are produced by adulteration with chalk, or China clay; starch also is sometimes used. A good blue is known by the following tests: it feels light in the hand, adheres to the tongue, has a dark, lively blue color, and displays, when broken, a copper red lustre. If adulterated with chalk or other carbonate of lime, it will effervesce when treated with acid; if with starch, it becomes pasty when mixed with boiling water.

Antwerp Blue is a lighter colored and somewhat brighter blue than Prussian blue, but possessing all the other qualities of that pigment, except its extreme depth. It has naturally a green tinge, rendering it well adapted for mixed greens.

Cobalt Blue is oxide of cobalt, with alumina. It is used to some extent in house-painting.

Blue Smalt is glass, colored with oxide of cobalt.

Blue Verditer is a blue oxide of copper, or precipitate of nitrate of copper with lime. It is a pale, bright blue, deficient in color, and not much in request, though it was formerly extensively used in making washes for walls, when paper-hangings were not as cheap and common as at the present day.

In color nomenclature, blues are distinguished by the following names: indigo blue, sky blue, pale blue, smalt, cobalt blue, ultramarine, or lapis lazuli, light blue, China blue, Prussian blue, and turquoise.

CHAPTER XVI.

RED PIGMENTS.

Of the primary colors, red has the most extensive range of combination. In the list of colored pigments, reds are the most numerous, and, in producing the tints and broken colors, the most important.

Red (including crimson, and scarlet, and purple) is the most pleasing of all the colors, and exercises a wonderful fascination for all ages and conditions of mankind. It is associated with our most pleasing recollections, and all our ideas of youth and beauty. We speak of rosy health, and rosy life, and rosy hopes. It has been the favorite color of poets and painters in all ages. It is employed to depict health and loveliness in woman, as those "*vermeil*-tinctured lips," and in the tomb-scene in "Romeo and Juliet," "for *beauty's ensign* yet . . . is crimson in thy lips and in thy cheeks, and death's *pale flag* is not advanced there;" and in the "Taming of the Shrew," we find, "such war of white and red within her cheeks;" and again in "Romeo and Juliet," "Else would a maiden blush bepaint my cheek." It is also the favorite color in most national emblems and in the ensigns of war, and ambition, and victory. Shakespeare says, in "King Henry II.," "He is come to ope the purple testament of bleeding war," and in the same, "Change the complexion of her maid—pale peace to scarlet indignation." Crimson is suggestive of health and strength, of womanly beauty, and manly vigor, and crimson sunsets give promise of bright days to come.

Nature has confined her use of reds mostly to the painting of the petals of flowers, and the tempting hues of luscious fruits, and the gorgeous plumage of tropical birds. Nowhere is it to be seen in the sky (except in occasional sunsets), in the water, or in the earth; and in the general landscape, so small is its proportion, compared with the other colors, that it may almost be said to have no place there.

Among pigments, Carmine is the purest type of red. This beautiful and familiar color is a product of the animal world, being the coloring matter extracted from the females of the insect known as cochineal. These insects abound in Mexico, and are fed on the leaves of a certain species of the cactus. There are plantations of this cactus, principally in the province of Oaxaca, where these insects are tended with as much care as is usually bestowed on silk-worms. At the proper season the insects are picked from the plant with a dull knife, and killed by being immersed in hot water, or by being placed in a hot oven. It is said that it takes seventy thousand of them to weigh a pound.

Carmine is prepared from the boiling solution of cochineal, by adding alum and carbonate of soda. It is said to have been discovered by a Franciscan monk at Pisa, in the preparation of a medicine of cochineal and salt of tartar.

Carmine is much used in dyeing, and not a little of it is consumed in imparting to the cheeks of fair maidens that beautiful bloom which is so much admired.

The grades of carmine are distinguished by numbers; that known as No. 40, being the highest grade.

VERMILION is a compound of quicksilver and sulphur, in the proportion of about one hundred parts of the former to sixteen of the latter. It occurs in nature as a common ore of mercury, called cinnabar. It is known to the trade as Chinese, Trieste, English, and that manufactured in this country, as California vermilion.

For many years the only vermilion used in this country was that imported from China, which comes wrapped in papers containing about one ounce each. It is now, however, used in comparatively enormous quantities, and the preference is given to the article of

English make. It is of different shades, and is distinguished as dark and light; the latter being the most expensive. Large quantities of Trieste vermilion also are consumed in this country, it being considerably cheaper than the English article.

Vermilion is a rich, bright color of dense body, and permanent when exposed to the light. American vermilion, so called, a rather poor imitation of true vermilion, is made from white lead and chromic acid (bi-chromate of potash). These are boiled together, washed, filtered, pressed, dried, and pulverized, either with rollers or with the hand. It must not be rubbed so hard as to break the crystals, or it loses its color, and shows what it really is, an orange chrome. The manipulation is quite detrimental to the health of the workmen engaged in its manufacture.

Venetian Red.—This most serviceable and permanent color is an artificial ochre, prepared from sulphate of iron. It is made in England, mostly in the vicinity of New castle-on-Tyne. When used in its pure state, it is one of the most durable colors known. The bright-red stain will remain on a building painted with it, long after the last vestige of the oil has disappeared, indeed, after the wood itself has become corroded by time and the elements. It is but little used in house-painting in its pure state; but is very serviceable in making grounds for black walnut, rosewood, mahogany, etc.; also, in making durable gray tints, in connection with blue.

Indian Red is a deep, lakey-red earth, chiefly a very rich iron-ore, or peroxide of iron. It is permanent, of very dense body, and is used mostly for tinting. With white and ultra-marine or Prussian blue, it produces fine, clear grays.

Red Lead is a pure oxide of lead, and is produced by exposing metallic lead to the action of heat, taking care not to fuse it. It is mostly employed as a pigment in painting iron vessels and iron-work generally. It has an affinity for the latter metal, and serves admirably in protecting it from corrosion. *Orange Mineral* is another name for red lead, and is produced by the slow calcination of white lead in iron trays. This form of red lead is not used as a pigment.

Light Red is burnt ochre, not used in house-painting.

Rose Pink, and the wood-lakes, are earthy substances, stained with the coloring matter extracted from tropical forest-trees. They are but little used in oil, but to some extent in decorative painting in water-colors, and in coarse scene-painting. The different sensations produced by red and its combinations are distinguished as red, carnation, blood red, crimson, scarlet, purple, vermilion, fire color, madder color, alkanet color, pomegranate color, cherry color, pink, peach color, damson color, claret, brown purple, violet, mulberry, lilac, apricot, and orange.

CHAPTER XVII.

YELLOWS.

In nature, pure, unmixed yellows are found mostly in the floral kingdom. This color is not specially a favorite, and must be sparingly used in internal decorations and furniture. Extreme fondness for vivid yellow is manifested mostly in uncultivated, undeveloped human intellects, as among barbarous negro tribes, and in young children. Generally, the hues of yellow are not associated with pleasant recollections, but with jaundice and yellow fever; an ill condition of health is indicated by a yellow complexion. The atmosphere assumes a yellow hue on the near approach of earthquakes and hurricanes. Undue secretions of the bilious fluid cause objects to assume a yellow tint. Blue discomforts seem temporary in their nature, fitful, soon to be succeeded by rosy hues; but yellow seems to be the tone of despair, of permanent melancholy. A yellow flag is hoisted on shipboard when an execution is about to take place; and yellow flags warn us of hospitals, fevers, and the "pestilence that walketh at noonday." A slight tinge of blue, no doubt, suggested the idea of "green and yellow melancholy." So prevalent an impression can hardly be the result of accident, but would seem to spring from natural causes.

CHROME YELLOW (*chromate of lead*) is, strictly speaking, the only yellow pigment used in house-painting, the yellow ochres being yellow browns of various shades. This brilliant yellow (chrome) is readily produced, and one so disposed may become an amateur color-maker at a small outlay of time and money. Sugar of lead (acetate of lead) in solution, and chromic acid (bi-chromate of potash) in solution, when mixed together, instantly assume a bright-yellow color, and precipitate, when left at rest, the pigment known as chrome yellow. This is washed in cold water, treated with lime, to produce the deeper or lighter tones, filtered, pressed, and dried. The result is pure chrome yellow, which is cheapened by admixture with carbonate of lead, barytes, carbonate of lime, and China clay. When pure, it is a body-color to the last degree, possessing a wonderful opacity and covering property, and also retains its color when exposed to the light, though it is peculiarly sensitive to the influence of gases. Sulphuretted hydrogen changes it in the same manner as this gas changes white lead, that is, by uniting with the lead, and forming a sulphuret of the latter metal.

Cadmium Yellow (*sulphuret of cadmium*) is one of the recently-discovered pigments, being produced from the metal cadmium in combination with sulphur. It is used mostly by landscape-painters—chiefly in representing gorgeous sunsets. It is the most intensely brilliant of any known yellow pigment.

YELLOW OCHRE.—This most useful and indispensable color is a native pigment, and deposits of it, varying in shade and fineness, are found in various localities. (The word *ochre*, in its original sense, signifies pale, but is now applied indiscriminately to all colored earths, whether yellow, red, brown, or black.) The most important are those known to the trade in this country as French ochres, and further distinguished as Rochelle ochre, and Havre ochre. The former is the more highly esteemed, being finer, and working more smoothly and freely under the brush. In house-painting, they are rarely used unmixed with white, as the pure color, when in oil, gives a rather deep yellow-brown ; but, mixed with white in varying proportions, fine, soft yellow drabs are produced, and pale delicate cream tints. These ochres are inflexibly permanent in color, and are exceedingly durable when exposed to the action of the weather.

The quantity annually imported into the United States is about three thousand casks, or a thousand tons.

Yellow colors are distinguished as chrome yellow, or lemon, brimstone, corn color, straw color, buff, saffron color, golden, canary, ochre, and orange.

CHAPTER XVIII.

BROWN PIGMENTS.

As has been before remarked, the natural brown earth-paints are, to a certain extent, more brilliant in tint, and produce clearer, purer tones of color, than do those paints which are the result of chemical operation. They are, too, as a rule, inflexibly permanent and highly transparent.

Terra-de-Sienna is a ferruginous native pigment, of a yellow-brown hue, producing, with white, bright sunny tints. That known in commerce as Italian sienna is the most esteemed, and is, in fact, the only article bearing the name of sienna which possesses any intrinsic value as a paint. The so-called American sienna is vastly inferior, both in color and transparency. Crude or raw sienna, when subjected to a high degree of heat, loses its yellow complexion, and takes on a deep, clear, brown-red hue, retaining, at the same time, all the transparency of the unburnt material. It is an invaluable pigment, and is extensively used in every department of painting. By admixture with Roman or yellow ochre, or raw sienna, or any other transparent yellow, and Antwerp blue or indigo, it affords fine olive greens.

Burnt Sienna is a rich, transparent brown-orange. It has strong coloring properties, and is permanent to the last degree.

UMBER.—Raw umber is a native ochre, and occurs in the island of Cyprus. It is known in the trade as Turkey umber, although a great portion of the umber sold in this market is obtained in the State of Virginia. Genuine Turkey umber is a soft, brown pigment, transparent in oil, and abounding in manganese, from the presence of which it derives its drying property. It is one of the most useful colors in the stock of the house-painter, and is much used in graining, and in producing, with white, pure quaker-drabs and browns. With blue, it affords a good neutral green, very permanent.

The American substitute for this pigment seems to possess none of the properties of the genuine article, except its resemblance in color.

Burnt Umber — the natural umber calcined—is much used both for graining, and for making, with white, clear, warm browns and stone-colors. No pigment, in the stock of the painter, is better known and appreciated than this: it is transparent and permanent. These colors (siennas and umbers) require to be very carefully prepared and finely ground, as it is only by reducing them to the last degree of fineness that they show their true colors.

Van Dyke Brown.—This useful paint is a bituminous earth of vegetable origin. The most valuable kinds are found in Germany. The color is a very rich, deep, transparent brown. It is a favorite color with many artists, and is used by the house-painter mostly for graining. It is valueless unless very finely ground. Boiled oil should be used in grinding this pigment, as it is a non-drier to the last degree. It is clear in its pale tints, and deep and glowing in shadows; very permanent.

Spanish Brown—a coarse native ochre of a dull-brown color, of dense body, suitable for roof-painting when a dark color is required. There are other browns, as sepia (the concrete gall of the cuttle-fish), mars brown (an artificial umber), Cassel earth (a native pigment), madder browns, etc. These are used principally by artists in landscape and figure painting, in oil and water, mostly, however, as water colors.

The browns are called broken colors, and known as brown, russet, red-brown, or horse-chestnut, chestnut, light brown, coffee color, tawny, sorrel (horse), and puce.

CHAPTER XIX.

WHITING AND PARIS WHITE.

The well-known article, common whiting, is produced from chalk. Chalk is a white, soft, friable carbonate of lime, containing more or less silicious matter and other impurities. These impurities are removed by grinding the chalk under a heavy edge stone which slowly revolves on a circular bed. The bed is surrounded by a water-tight tank, into which flows a constant stream of water. The particles of the crushed materials, agitated by the stone in its motion, are temporarily held in suspension by the water, and flow off with it into large sunken vats, a number of which, placed side by side, are connected by troughs; the overflow of the first vat is received by its nearest neighbor, and so on, until all the vats become filled. The vat farthest from the mill will, of course, contain the finest deposit of all, from the fact that the purer material will be longest held in suspension. The deposited mass, when of proper consistency, is lifted from the vats and thrown upon thick, roughly-shaped blocks of chalk which absorb a portion of the water, and in a short time so harden the cakes of whiting that they may be handled. They are then taken from the blocks and dried, by exposure to the air, in a kind of lattice framework. Paris white is produced by the same method, but the material used is a finer, harder kind of carbonate of lime. Paris white is consumed mostly in coating walls and ceilings either with or without tinting. Previous to the late war, chalk was not subject to any import duty, and was brought as ballast by the London packet-ships. At that time it was common for ship-owners to pay for taking the chalk-ballast from the side of the vessel, so that the cost to the whiting manufacturers was really nothing. During the war the price of chalk was at one time as high as forty dollars per ton, and large fortunes were in some instances realized by the lucky holders of large stocks of this material. The annual consumption of whiting and Paris white in the United States is enormous—not less, probably, than eighty thousand barrels, equal to about thirty millions of pounds.

6

CHAPTER XX.

OILS.

Oils are divided into two great classes: the fat or fixed oils, and the volatile oils. Linseed-oil is a very good example of the former class, and oil of turpentine (spirits of turpentine erroneously called), of the latter.

These two fulfil all the requirements of the house-painter, and are the only ones of any particular importance in the trade. All fixed oils and fatty substances, whatever their origin, possess the same ultimate constituents, and mostly in like proportions, and differ but little in specific gravity. That is, the weight in proportion to the bulk is nearly the same in all. The extremes being 0.96 for castor-oil, and 0.89 for cocoa-butter. The specific gravity of linseed-oil is 0.934. Supposing a cubic foot of water to weigh one thousand ounces, the same bulk of linseed-oil will weigh nine hundred and thirty-four ounces.

Linseed-oil was formerly measured by the gauging-rod, in this country, but now by weight, seven and a half pounds being the standard of weight for the measure of a gallon.

Certain oils, in contact with the air, undergo progressive changes; they thicken, and eventually dry into a transparent, yellowish, elastic substance which, after very long exposure, becomes hard and brittle. Linseed-oil seems to possess this property in a greater degree than any other, and from this derives its value in the preparation of varnishes and painters' colors. Many of the fixed oils possess this siccative or drying property; particularly those extracted from seeds and nuts. Some of the animal oils also possess it in a greater or less degree, but linseed is the only article which gives oil possessing this property in sufficient quantities for general use.

The cause of this change from liquid to

solid is brought about by absorption of oxygen from the atmosphere, it being purely a chemical process, and not the result simply of evaporation, as some suppose. This drying property in oil may be greatly increased by boiling the same in connection with certain metallic oxides, such as red lead and litharge. These articles only, were in former times used for this purpose; but of late, the black oxide of manganese is extensively used. Turkey umber also, to a certain extent, is employed by varnish-makers, for this purpose; but that article derives its drying property from the presence of the last-named oxide. A varnish, made by dissolving gum-shellac in linseed-oil and turpentine, was formerly used almost exclusively for facilitating the drying of paint, but has mainly given place to a combination of metallic oxides, known to the trade as "Patent Dryer," which seems to answer a better purpose than any thing yet discovered.

Linseed-oil is obtained from flaxseed, by grinding the same under heavy stones set on edge, and made to revolve on beds of stone. Attached to the edge stone are scrapers, which throw the seed into the circular track of the roller. The ground seed is placed in strong, woven, woollen bags, which bags are covered with mats made of horse-hair and sole-leather, of a proper and sufficient width to protect the bags in the operation of pressing. These mats with their contents are subjected to an immense hydraulic pressure, and the expressed oil flows off into large iron tanks, where it is allowed to settle. What remains in the bags after the pressure is known as oil-cake. The great bulk of this article is exported to England, where it is sold as food for cattle. The following figures will convey an idea of the enormous amount of linseed-oil used in the United States: There were imported into this country, in the year 1867, 2,000,000 bushels of linseed—mostly from Calcutta—which would give four million gallons of oil. The home product of flaxseed (or linseed) for the year is estimated at from 1,750,000 to 2,000,000 bushels, affording, at the lowest estimate, 3,500,000 gallons of oil—making a total of 7,500,000 gallons—most of which is consumed at home. In addition to this, there were imported from England 250,000 gallons of linseed oil, making a grand total of say 8,000,000 gallons.

Admitting the correctness of the theory heretofore advanced, that the consumption of paint affords the best standard whereby to measure the progress of a people in the best civilization, it must be admitted that we are marching with rapid strides in that path.

Adulteration of Oil.—The adulteration of linseed-oil is practised to a very great extent, in this country, at the present day—probably more so than at any former period. The high price which this article has borne since the second year of the war, in comparison with some of the less useful oils, has stimulated the ingenuity of men of an inventive genius, to mix the articles, and sell the mixture under the name of the most respectable of the two oily copartners. As before said, the comparative high price of linseed-oil has rendered the process of adulteration profitable, even when the proportion of the cheaper material amounts to but a small percentage of the mixture. For example, supposing the market price of linseed-oil to be one dollar and fifty cents per gallon—which would be a fair average of prices during the last three or four years—the substitution of only ten per cent., or four gallons to the barrel of forty gallons, of an oil the market value of which is only sixty cents per gallon, gives a profit of three dollars and twenty cents; an enormous profit on an article of such general and certain demand, and which is sold at wholesale ordinarily at a merely nominal profit.

The adulteration, by mixing with inferior oils, is carried to a greater extent in boiled than in crude oil, as the liability to detection is much less with the former.

There are various tests for determining the purity of oil, but, unfortunately, those which are the most reliable are of no practical value to the painter. The application of a few drops of sulphuric acid to a film of the oil to be tested, on a piece of glass, is a good method of ascertaining its purity; but this involves a knowledge of the peculiar effects of this acid upon the different oils. A simpler method, but less reliable, is to heat the oil, when the presence of another oil may be detected by the odor which exhales. Specific gravity also is a good criterion. The instrument used for determining the gravity of oil is called an oleometer, which is graduated to sink to zero in a certain oil raised to the temperature of boiling water. Linseed-oil is the most dense of any of the fixed or fat oils, with the single exception of castor-oil; therefore, an oleometer graduated to sink to zero in pure linseed-oil, would of course sink lower in linseed-oil which contained fish-oil, or any of the oils of less specific gravity, and the measure of adulteration would be shown by the figures on the stem of the instrument.

The presence of fish-oil in linseed-oil may be detected by agitation with a little chlorine gas, which blackens the animal oil, but has little or no effect on the vegetable oil. Unfortunately, these modes of testing are troublesome, and involve a certain outlay of time and money. The best inexpensive and ready test which the writer can suggest, is to put a few drops of the suspected oil in the palm of the hand, and then rub the palms of the two hands briskly together; after this has continued a minute, by applying the hand to the nose, the presence of fish-oil will reveal itself by its peculiar odor. These directions are of little value to those who conduct business in the large cities, and who can purchase their stock of oil directly from the crushers of seed; but it is hoped they may be useful to those who are remote from the place of manufacture, and who must ordinarily purchase from second or third hands.

Oil of Turpentine.—This indispensable article, known to the trade as spirits of turpentine, is obtained by distilling the sap which flows from that species of the pine known as *Pinus australis*, or long-leaved pine, which grows in great abundance on the coasts of North Carolina and Georgia. The turpentine is procured by tapping the tree at first near the ground, with an axe made for the purpose. From one to three box-like cuttings are made in a tree, having a capacity each of two or three pints. The sap, which runs from the tree only in warm weather, begins to flow freely in March, and is dipped out from the boxes with a peculiar-shaped ladle, and deposited in barrels. The sap hardens on exposure, and soon forms a coating on the surface of the wood, which stops the flow. This surface must be removed occasionally to renew the flow of the sap. Formerly, the bulk of the turpentine produced in North Carolina was exported in a crude state for distillation in the North, but now the principal portion is distilled in the State, the larger proprietors having stills of their own. These are not unlike the stills used for the distillation of spirits from grain and other substances, and have a capacity of from five to twenty barrels each. After the turpentine is drawn off, the residuum forms the common rosin of commerce.

When the trees are no longer profitable for their yield of turpentine, they are felled, cut up, and charred in kilns, producing tar which, by boiling, is concentrated into pitch. The yearly average product of one acre of turpentine forest is from twelve to sixteen barrels of crude turpentine, which yield about two barrels of spirits of turpentine and eight of rosin.

The statistics of the turpentine product, always difficult to obtain, are more so now than formerly. Before the war, the estimated annual product of North Carolina was 800,000 barrels of crude turpentine, equal to about 115,000 barrels of spirits of turpentine, and 450,000 barrels of rosin.

Oil of turpentine is a most important, indeed indispensable article in house and other kinds of painting, but it requires to be handled with skill and judgment. As a rule, too much of it is used in exterior work, and not enough in interior work. When used to any considerable extent for exposed situations, it impairs the water-proof property of the paint, and consequently its durability. Colors mixed entirely with turpentine are but little more durable than water-colors. In the preparatory coats for dark-grained work, such as outer doors and vestibules, when a finishing coat of varnish is applied, the proportion of turpentine should be as great as possible; such work, being exposed to the direct rays of the sun, becomes so heated that it is very apt to blister, whereby the best job will be completely spoiled. The remedy for this state of things is expensive and troublesome, it being no less than the entire removal of all the paint, either by washing with powerful alkalies, or by the application of a high degree of heat, and scraping. Such a result can be prevented only by using as little oil as may be, to spread the paint evenly, and finishing with the best attainable coach-body varnish.

For interiors, turpentine is used in the finishing coat almost entirely, for the reasons that clearer, purer tints are attainable than with linseed-oil, that the paint does not discolor so quickly, and the flat, dead finish which it produces conceals, by its lesser reflective power, the irregularities and imperfections of the surface.

Spirits of turpentine dissolves all resinous substances, and is a very good solvent for India rubber.

CHAPTER XXI.

THE ACTION OF LINSEED-OIL UPON PAINTS.

Of all the fixed and fatty oils, linseed-oil, when not exposed to the atmosphere, undergoes the least change of condition. It does not become rancid and emit an unpleasant odor, as do the animal oils; nor does it thicken and become viscid, as do some of the vegetable oils. It remains limpid under all ordinary temperatures, and does not congeal till cooled from 4° to 18° below Zero.

All these qualities fit it admirably to serve as a vehicle for mixing and spreading paints. It has no effect on paints except simply to darken the shade or tint and render them less opaque. This is shown by mixing whiting or Paris white with oil. These substances are, when dry, to all appearance as opaque as white lead; but when wet with oil they become semi-transparent, and assume a yellowish tint. The effect is the same precisely as to saturate white writing-paper with oil. It loses its opacity and becomes transparent. (This word is used in its common and not in its technical sense.) White lead, from its wonderful opacity in body, is not thus affected, and from this property it derives its chief value as a pigment. In no other respect does linseed-oil have the slightest effect on the paint when mixed with it.

No possible preparation of the oil can change the nature of the pigments which are put into it. Within the last ten years it has become the custom of the trade to mix white paint for grinding in oil which has undergone the bleaching process. This operation of bleaching is performed either by subjecting the oil to a certain degree of heat, or by treating it with acid and afterward washing with steam.

In either of these processes the oil precipitates a portion of its coloring matter and assumes a paler tint; otherwise it undergoes no change, and, economically considered, the operation is a losing one, there being a decrease of bulk, with no corresponding gain in quality; added cost, with no improvement in either the water-proof or siccative property of the oil. No pigment is improved, either in density, covering property, or tint, by being mixed with linseed or other oil.

Some of the greens and blues, it is true, assume a darker hue on being mixed; but this is equivalent to varnishing. A better result still is produced by mixing them in water or turpentine, and afterward applying a coat of varnish. What the writer wishes to enforce, is the fact, that no possible preparation of oil can impart a value to materials which of themselves are valueless.

The material used for adulterating paints is of itself utterly and totally without value as a pigment, and it only becomes in a degree respectable from its association with materials which are intrinsically valuable. The oil which is used to spread it cannot improve it, or change its nature.

To speak of oil as the base of paint is the veriest nonsense. With as much propriety may it be said that water is the base of pigments which are used as water-colors, as that oil is the base of oil-paints. Water would be the better menstruum for paints, if some process could be discovered of rendering water-color painting water-proof. Varnish, certainly, does this, but varnished work is not suitable for interiors; it produces a shiny, cheap, tawdry appearance, and reveals all the irregularities on the surface of walls and woodwork which it is most desirable to conceal. For outside work varnish is unsuited, because it will not resist the action of atmospheric influences. It cracks, grows rusty, and requires frequent renewal. An oil, to be perfectly adapted to the requirements of the painter, must possess the property of drying quickly, without stickiness, must be inodorous (or at least free from any unpleasant odor), colorless, limpid—must not congeal, except at very low temperatures, must not discolor or turn yellow when not exposed to the light, and must be entirely water-proof. When an oil, either vegetable or animal, fulfilling all these conditions better than linseed-oil, shall be found, and can be furnished in sufficient quantity at a price no greater than the average price of the oil produced from the seed of the flax-plant, the finder may cry, "Eureka!" So far, no unctuous oil, except the oil of linseed, has been discovered, which possesses any two of the above-named necessary properties combined with the first, which does not exceed the latter so far in cost of production as to render its common use altogether impracticable.

The flax-plant should have a prominent place in the coat-of-arms of the guild of the house-painters, for without it the trade would hardly have had an existence.

CHAPTER XXII.

VARNISHES.

Except to gratify a laudable curiosity, or to satisfy a thirst for knowledge, the details of the mode of operation, in the manufacture of varnish, are of no benefit to the house-painter or to the public. Time was, when a practical knowledge of varnish-making was known to the few, and formulas or recipes for producing the various kinds of varnishes and japans were held in high esteem, and had a certain value. To-day the business of manufacturing varnish has increased to enormous proportions. So great is the amount of capital employed, and the skill developed by competition in the effort to produce the best article for a given price, that to make varnish in small quantities, in a domestic way, is altogether impracticable. There are now no varnishes used in house-painting (with a single exception which will be mentioned hereafter) which can be profitably manufactured at home. Ordinarily, the cost of material alone would be as much or more than would be the cost of a better varnish than could under any circumstances be produced by one not skilled in the proper manipulation of the materials, and lacking the appliances necessary to produce the best results.

The exception before mentioned is the white lac-varnish used for covering the knots, and pitchy and discolored spots, which occur in all new pine-wood work.

This is made simply by dissolving bleached shellac in alcohol, in the proportion of two pounds of the former to one gallon of the latter. More or less of the gum may be used to give the required strength. The varnish is easily diluted by the addition of alcohol, or made stronger by the addition of more shellac. (In cases where color is not important, the ordinary unbleached shellac will answer, and the cost is much less.)

It is most readily prepared in a tin can or bottle, which requires occasional shaking during the process. A gentle heat facilitates the operation. It may be prepared in greater or less quantity, and rendered perfectly transparent by passing it through a filter paper. It then becomes the best possible varnish for pictures. The alcohol must be of a strength of ninety-five per cent.

Mastic Varnish is made by dissolving gum-mastic in spirits of turpentine. Of a certain strength, this varnish thickens linseed-oil, and makes what is called megilp.

The varnishes used by the house-painter are made by melting gum-copal at a high degree of heat, and adding thereto linseed-oil and spirits of turpentine in certain proportions.

Copal (*Mexican Copalli*), a generic name of resins, is the concrete juice of certain trees growing mostly in the East Indies.

It is hard, shining, transparent, yellowish-colored, inodorous, resembling amber; strictly it is neither a gum nor a resin: not being soluble in water as are the gums, nor in alcohol as are the resins.

The most useful and valuable is that which comes from the Mozambique country, and is known in commerce as Zanzibar gum.

This copal, it is said, is dug out of the sand, and not a vestige or trace of the tree which produced it is visible in the places where it is found. Geologists are agreed that this substance is of antediluvian origin.

The copal next in value to the Zanzibar gum, is known in trade as Benguela gum. An inferior gum called Kowrie is now much used by varnish-makers.

Rosin also is used by some manufacturers in cheapening varnish. It is, however, at best a poor substitute for copal, and the safe course for consumers of varnish to pursue is to buy only from well-known and responsible parties.

Gum-copal expands on melting by heat, and on exposure to the air has a tendency to shrink to its original bulk. This causes the surface to crack, and quite spoils the effect of the best *grained* work. (The art of imitating colored wood by painting is called by painters GRAINING.) The best possible piece of work of this kind may be completely spoiled by the application of a coat of poor, cheap varnish. The only remedy is to begin anew and have the work all done over again.

"Quick-drying" varnishes are not suited to the varnishing of painted work. Those known as coach or carriage varnishes only should be used. Good coach-varnish may be mixed with pure boiled linseed-oil, in the proportion of three parts of the former to one of the latter, to good advantage. The oil renders the varnish more elastic, and prevents its hardening to the point of cracking.

BEST COACH-BODY VARNISH.—The best coach-varnish is made by melting, in a copper kettle made for the purpose, best Zanzibar gum, and adding gradually thereto prepared linseed-oil, heated to about 350 degrees, in the proportion of about three pounds of gum to one gallon of oil.

These are boiled together for a time, and then allowed to cool partially. Spirits of turpentine is then added in quantity about equal to the oil, previously stirred into the melted gum. This varnish improves by age, and should not be used sooner than five or six months.

Best Carriage-Varnish. — This differs from the coach-body varnish only in the use of a less quantity of oil and turpentine in proportion to the quantity of gum and the greater quantity of turpentine in proportion to the oil. The mode of operation is the same.

Inside, or Furniture Varnish.—Quick-drying varnishes for rubbing and polishing are made usually from mixed gums, gum-kowrie entering largely into the composition of some of them—the proportion of linseed-oil and spirits of turpentine being about one of the former to three or four of the latter.

White Demar Varnish.—This varnish, which is used mostly with white zinc for producing what is called "gloss" or "porcelain finish," may be made by dissolving gum-Demar in cold spirits of turpentine in the proportion of about five pounds of gum to one gallon of turpentine; a gentle heat however, hastens the operation of solving the gum, and possibly produces a better result.

Black Japan Varnish.—This article is used for hardware generally, and is composed of asphaltum, copal,—either Zanzibar or Benguela,—prepared linseed-oil, turpentine, and benzine. This varnish must be dried by heat, and is called "Baking Japan."

A so-called self-drying japan is made of asphaltum by itself, without the addition of copal. This is used on trunks and articles where it is not convenient or practicable to apply artificial heat.

The latter varnish, reduced with spirits of turpentine, makes what is known as black-walnut stain. Rosewood stain is a solution of extract of logwood in alcohol in proportions to meet the taste; about four pounds of extract to a gallon of alcohol is generally used.

Gold Lacquer is made by dissolving shellac-gum, sandarach, and crude turpentine in alcohol. This varnish is colored by the addition of an alcoholic solution of gamboge and alkanet-root in proportions to produce the desired tint.

French Polish is made by dissolving bleached shellac in alcohol in equal proportions by weight. It is applied with a pad made of a wad of cotton-wool wrapped in a linen rag. The pad must first be dipped in raw linseed-oil, then into the varnish, and rubbed quickly on the work. The operation of French polishing requires great skill and dexterity in the manipulation to produce a good result.

In closing this chapter on varnish, the

writer would again call the attention of the consumer to the importance of using great care in the selection of the same. The application of varnish is the finishing touch to the work, and a coat of poor varnish may waste all the previously expended labor and material.

As a rule, buy only of makers of known reputation, who cannot *afford* to use inferior materials.

All the gum consumed by varnish-makers in the manufacture of the various kinds of varnishes, is the production of foreign countries, there having been as yet none of this material discovered within the limits of the United States.

The quantity imported in the year 1867, including asphaltum (which is used in making the black varnishes), was not probably short of four millions of pounds. The quantity of oil necessary to convert this amount of gum into varnish would be about two hundred and seventy-five thousand gallons of linseed-oil, and about one million gallons of oil of turpentine and benzine, which would produce about two million gallons of varnish, equal to fifty thousand barrels of forty gallons each.

CHAPTER XXIII.

PREPARATION OF WORK FOR PAINTING.

In preparing work for painting, too much care cannot be exercised, as succeeding coats and the final result depend very much on the proper condition of the work when the priming coat is applied. First, all the rough places in the wood should be rubbed down with a block covered with sandpaper; and the mouldings and beads should be well cleaned out with sandpaper. Then (and this is a matter of prime importance), every knot, however small, every indication of sap on the wood, or discoloration of any kind, and every appearance of pitch or gum, should be carefully varnished over with white shellac varnish, if the work is to be finished in white or light tints—

or with varnish made from unbleached or common shellac, if the work is to be finished in dark shades. The common shellac, in the latter case, answers equally well with the bleached article, and at less cost. This should not, under any circumstances, be neglected, as it is impossible, in the nature of things, otherwise to make good work.

When work is to be finished with two coats, the putty used for stopping the nail-heads and other indentations, should be made of white lead, worked up with common whiting to the proper consistency, and the filling should be done after the first coat shall have become well dried. When more than two coats are to be applied, the filling should be done between the first and second coats, with ordinary pure linseed-oil putty.

It should be adopted as a rule, never to apply pure white as a priming coat; no matter whether the work is to be finished with one or four coats, the result will always be more satisfactory if the first coat be stained. A little finely-ground lamp black answers as well for this as any thing.

The only way to produce solid, uniform work, is by making every succeeding coat lighter in tint than the one which preceded it. This is specially the case with walls, and other extended flat surfaces. *No matter what the finish is to be, the first coat should always be darker than the one which succeeds it;* and the darker the shade of the finishing coat, the more important it is that this rule should be observed. If the work is to be finished with black, prime with black. If with green, let that be the color of all the preceding coats. If with blue, let that color be the ground-work. What can be more stupid than applying to work which is to be finished in imitation of black-walnut a priming coat of white? *All work should be primed especially with regard to the finishing color.*

There is not half enough of dark colors used in priming applications. Venetian red, finely ground in boiled oil, deeply stained with black—and used very thin, in order to stain the wood as much as possible—is the best first coat for work which is to be finished in imitation of black-walnut or other dark wood. The succeeding coats should be as dark as may be with a view to the proper shade of ground-work for the graining. In such case, if (as must happen in the ordinary course of events) the work becomes bruised or "chipped"—by an accidental knock from a chair-leg or other article of house furniture—the general appearance of it is little impaired thereby. Quite the contrary, however, is the case if the underneath coats are white. Then, an accident of the kind before mentioned, shows a white spot, which staringly proclaims the work to be a delusion and a sham. Dark colors, too, as the Venetian red before mentioned, make better foundations than white lead or zinc. They dry harder and "rub" better, and, what is most important, cost less.

This matter having been duly considered, let us now proceed to the coats succeeding the first. Before applying a second coat, the first should be carefully rubbed and all the nail-heads and other indentations carefully stopped with pure linseed-oil putty—using for flat surfaces a square-bladed putty-knife. Puttying with the fingers should never be tolerated (good work is now the subject under consideration). This done, the whole should be carefully examined to ascertain if the oil in the former coat shall have revealed any resinous or pitchy spots, not previously covered with the shellac. (But for the present high price of alcohol, the writer would recommend the application of thin shellac varnish to the whole surface, between the first and second coatings.) These preliminaries being attended to, the work may be considered ready for a second coat. The directions as to rubbing with sand-paper are to be observed in all the succeeding coats. As a rule, on interior work, paint should never be applied to a surface which has not been previously rubbed.

Sandpaper for fresh work and pumice-stone for old work. Always distrust the education of a painter in his trade who goes to work without a lump of pumice-stone, a sheet of sandpaper, a putty-knife, and a rag to wipe off the spatters—sparks, as the Irish not inaptly call them. *Apropos* of spatters! Every painter has seen (the result too of unpardonable negligence) plates of glass so covered with spatters, that to remove them would require more time than would serve to paint the wood-work of a "full-trimmed" window.

In priming work which is to be finished in oak, finely-ground French ochre is recommended. The objection to this pigment, that it does not work smoothly and easily under the brush, has arisen from its coarseness. Finely ground in boiled oil, it works as smoothly as white lead, and makes an excellent foundation for the succeeding coats.

For walls the first coat should be as dark in shade and as thin as practicable, the object being to stain the plaster as much as possible. Indeed, if the whole mass of plaster could be stained through and through, it would be desirable to so stain it.

The use of glue in wall-painting is of doubtful propriety. It should never, under any circumstances, be put on until after the second coat, and then rubbed on with a rag, very lightly. In first-class work, however, its use is not recommended.

Plaster mixed with weak glue-size—which prevents its setting too rapidly—is the best material for stopping walls preparatory to painting, and each coat of paint should be carefully rubbed with worn sandpaper, before the succeeding coat is put on. For preparing walls a small pocket-trowel will be found a most serviceable tool, or a trowel-shaped putty-knife, which article is now coming into general use.

The preparation of ceilings for whitewashing (or kalsomining, as this operation is sometimes pretentiously called) is an operation requiring some skill and knowledge of "how to do it." A dirty ceiling, which has been subjected to successive coats of whitewash, whether of lime, or whiting and glue-size, cannot be made solidly and smoothly white by additional whitewashing. The mass has become spongy, and sucks up the water so quickly, that the material cannot be evenly distributed. In such case, the only way is to begin anew, to go at once "down to hard pan" by removing all the previous applications by washing and scraping. This is best effected with a broad-bladed square-pointed putty-knife, keeping the ceiling wet meanwhile. Plaster (hard-finish) is not of uniform density, and some spots are much more absorbent than others. To remedy this, a mixture of soft soap and alum, dissolved in water, should be applied with a broad kalsomine brush.

It is not assumed that mere verbal instruction can teach the art of whitening or tinting walls and ceilings in water-colors. To produce good results, great skill in preparing the materials and dexterity in manipulation are required; and such work should be intrusted only to competent hands. A mass of unsuitable material may be cheaply put upon a ceiling; but when the same shall require repainting, the cost of labor will be greater in removing the previous coating, than will be the whole cost of repainting. These remarks, too, apply equally to all kinds of painting; and reference is made to the whitening and tinting of ceilings only, because of the general impression that this kind of work may be performed by anybody.

The materials and tools used in painting are too costly to be wasted and worn by incompetent handling. "Painting up, just to keep the gardener or hostler out of idleness," will prove in most cases a left-handed economy. Such experiments are prudent only when the services of skilled workmen cannot be obtained.

CHAPTER XXIV.

DECORATIVE HOUSE-PAINTING.

It must be admitted that, as a people, we are sadly indifferent to the effect of color for decorative and ornamental purposes;—no people more so. Certainly none have shown less disposition to study the harmonious arrangement of colors, either in furniture or architecture. It would seem that in this respect we are just emerging from a condition of barbarism—but that all semi-civilized and barbarous nations evince far more natural taste in the arrangement of colors, and skill in colored design, than we do. It may be said that a people, with the task on their hands of subduing a vast continent and bringing into subjection the rude forces of Nature, have weightier matters demanding their attention than the arrangement of patches and stripes of colors to please a childish or frivolous fancy. This proposition, if offered in excuse, would perhaps be pertinent if, as individuals, we were not given to indulgences far less important than the harmonious combination of colors. If we were a patient, plodding, laborious, painstaking people, given over to the pursuits of gain—utilitarian in our habits and modes of life—there would be more excuse for this neglect of the education of the perceptive faculties. But such is not the case. We are a most extravagant people, not only in our modes of living, but in our modes of thinking. We waste more than some nations consume; and we look upon economy as at best a negative virtue, which a proud-spirited people cannot consistently practise.

It is *not*, therefore, from the want, either of leisure or of means, that we neglect to educate ourselves in the various branches of ornamental art, which, if properly cultivated, would serve to render beautiful as well as useful articles of every-day requirement; nor is it from an indisposition to spend our money for the encouragement of decorative art. How many lavish enormous sums in the purchase of pictures which are placed in houses furnished throughout with not the slightest regard to harmony, or proportion, or beauty of design, or finish! Many of the houses of our rich men are frightful, from the abundance of gaudy and meretricious ornamentation! Indeed, we spend more money, in proportion to what we get for it, than any people on the face of the earth.

What we require most, is to free ourselves from the slavery which we are under to fashion and custom and servile imitation! We must become, in our modes of thinking and in our modes of acting, more independent. There must be more of individuality, of self-assertion, and less of subserviency to the prevailing fashion of the moment. We boast of our independence—yet in such matters we do not make it manifest.

Few—either men or women—have the courage, in the furnishing of their houses, to ignore the prevailing fashion, however much that fashion may set at defiance all rules of harmony in arrangement and adaptation.

For example: *paper hangings* are the mode, and we cover all our walls with paper, much of which is perfectly frightful, both in design and color.

An invalid lying in bed in some of our papered rooms, with no mental occupation but that of tracing the figures on the walls, will be forced to hide his head beneath the bedclothes to escape the appalling images which his diseased fancy will have conjured out of the ill-regulated designs and patterns which, in spite of himself, meet his gaze, turn whichever way he may.

Again: what is called plain painting is the prevailing custom, and we rush to strip from our houses the painted paper, and a plain dead level of sombre neutral tints takes the place of the many-hued, cheap, and too often gaudy hangings—an improvement, perhaps, because less liable to add to the horrors of a distempered fancy, and more in consonance with the laws of health. If nothing more is gained, cleanliness is promoted by the change.

White walls for a time prevail, and we put forth frantic efforts to find some substance which shall rival the new-fallen snow in whiteness. This spasm of puritanism gives place to panelled work, and we have panels and mouldings everywhere, in halls and vestibules, in parlors and bedrooms, with high ceilings and low. *Now*, brighter hues become the fashion! *Fresco-painting*, so-called, is the prevailing, and, *therefore*, proper style for walls and ceilings, and parti-colors cover the plain white which has so long held a place.

A *soi-disant* fresco-painter is employed, and the white walls disappear under sky-blues, and blue and red-grays, and pink and gilding, laid on by lavish but unskilful hands —not only without regard to harmony either by analogy or contrast, but too often with no fixed intent or purpose.

Carpets are chosen with no regard to the movable furniture, and pictures are hung against walls so dazzling with colors and gilding that the brightest hues on the canvas become dull and dingy by comparison.

Living so much in-doors as we do, it is of the first importance that the articles we have constantly before us in our houses, and to which the younger portion of the household are so much indebted for early impressions, should be beautiful and in good taste—that the eye may be *educated* by the *habit* of seeing what is good. We must discourage to the last degree the idea that beautiful designs are to be found *only* in costly and expensive objects, and that the wealthy alone have such within their reach; for, so long as taste is confined to a few individuals, and is not introduced into the ordinary ornaments and utensils of every-day life, it will continue an exotic and a luxury. There is no reason why these articles of every-day use may not be made beautiful as easily as they now are too often hideous and misshapen.

To be of use, taste should pervade all classes; all portions of the community should be afforded the means of educating the eye; for there can be no hope of improvement in the production of articles of every-day requirement, if those who create them are ignorant of the simplest notions of taste, and cannot even comprehend the beauty of a design when it is presented to them. *It is not by the education of the wealthy that taste can be spread through a country.* Our theory of general education, almost "without money and without price," is excellent so far as it goes, but it does not go far enough. It has not sufficient scope and extension.

We expend our energies in the development of the intellectual faculties and forget that there are perceptive faculties, which need development and education. We teach the ear to comprehend the harmony of sounds, but make not the slightest attempt to educate the eye in the harmony of color! Yet how much of the pains and pleasures of every-day life do we realize through the sense of sight! To be *deprived* of this faculty is considered the greatest misfortune. Is it not a misfortune to have eyes and see not?

The school-room is of all others the place where good examples of colored ornamentation should be displayed.

It is the least expensive and troublesome of all kinds of teaching; for, with good examples, the eye becomes self-educated.

Every common school should be a school of design in the best and most comprehensive sense of the term; and the fact should be impressed upon the minds of all, that objects possessing proportion, form, and other conditions of beauty, need not *necessarily* be expensive.

The humblest individual may display an innate perception of the beautiful in the ornamentation of a homely cottage and in the poorest materials. It should be remembered by those of limited means that the selection of the beautiful depends upon the judgment, and is not confined to the wealthy.

The bad taste displayed in the over-furnished rooms of many of our rich men is convincing proof that good taste is not confined to the wealthy members of a community, nor the possession of beautiful designs to those of ample means.

It is not enough that the interior of our dwellings and public buildings should be covered with one or more coats of white or pale-tinted paint. The panels and mouldings which have been introduced there for architectural effect and beauty, should be made to serve a double purpose in the way of colored ornamentation. Nothing can be said in defence of the custom which has until within a few years almost universally prevailed, of painting the walls and interior wood-work of our dwellings with one unvarying color, that will not apply with equal force to the carpets, hangings, and general furniture.

As has been before remarked, that puritanic fashion has had its day, and is about to be numbered among things that were. We must now guard against the other extreme, and not suffer our houses to be streaked with colors and tints laid on by unskilful hands, without regard to harmony or tasteful arrangement.

The fashion for compound hues, neutral tints, grays, and other so-called quiet colors, is giving place to a preference for combinations of red, blue, yellow, and other colors of the prism. It has been the custom to decry these colors as gaudy. But bright colors are not *necessarily* gaudy. It is only when they are put together without due regard to their suitableness to each other, and their relative quantities in the arrangement they require, that they appear gaudy and glaring. A union of bright hues, without regard to harmony, must of necessity be disagreeable to the eye educated to a knowledge of what constitutes true harmony in the combination of colors.

There are some, however, who are as completely insensible to the effect of such harmony, as they are to that of musical sounds. It is, therefore, of great importance that those whose business or profession it is to arrange colors in harmonious combination, should be thoroughly imbued with the true feeling for it, and should possess that natural perception, which, though it may be improved by study, cannot be acquired when the natural faculty is wanting.

No mere theory, however pretentious, can teach the art of combining colors in harmonious arrangement. The power depends upon the perceptive faculty, and unless a person possess this, he will vainly attempt to lay down rules for the guidance of others. Rules may be given for the direction of those who do not possess the faculty of detecting discords in colors, but they must be the result of observation. Because such and such colors stand in a certain relationship to others, or are compounded in a certain manner, it cannot be affirmed that they *must therefore* accord or disagree with some other color. The question is not whether they *ought* or *ought not* to agree, but whether they *do* or *do not* agree.

What we want is a knowledge of a proper combination of colors, derived from the experience of those who possess an intuitive perception of it, and it is the eye alone which must be consulted as the proper judge of what it sees.

CHAPTER XXV.

HARMONY AND DISCORD OF COLORS.

It must be borne in mind that, in the combination of colors, there are some which, by contrast, set off other colors, and materially heighten the effect, while others decrease it. Of course, much depends upon proportion, and so great is this influence, that colors which suit each other in one instance, will have a disagreeable effect when one is too great or too little in proportion to its neighbor. And such a result will be produced in a carpet, or other colored object, when the colors and hues offend against these conditions.

In studying the harmony of color, it is certainly important to know what colors, when placed together, are concords, and what are discords; but so much depends upon proportion, that no rule can be laid down which shall be a guide in this respect; therefore, it would be a hopeless task to attempt to educate a person in the art of decorating with colors whose perceptive faculties are deficient in distinguishing what are or what are not proper proportions.

Few persons are so color-blind as not to experience the disagreeable effect produced by placing in juxtaposition alternate stripes of red and green. But this is not enough. It is necessary to know what tones of these colors are least discordant, and what color is wanting to change this discord to harmony, supposing such a result to be possible.

Harmony of color must not be understood as meaning similarity of color. There is a *harmony by analogy*, and a *harmony by contrast* also. As examples of the first, may be mentioned crimson and rich brown, crimson and purple, yellow and gold. Of the latter (harmony by contrast), scarlet and blue, orange and blue, yellow and black, white and black, etc.

There are also colors which diminish each other's effect, as green and red. This fact is well known to those of the fair sex who have fire-colored hair, and they avail themselves of this knowledge, and soften the force of the too bright red by a liberal use of green. Blue, on the contrary, being a contrast to red—particularly fire-red—sets it off, and women with red hair (when that tint does not happen to be the mode) are justified in their habit of diminishing its intensity by the use of the other more suitable color.

The object in ornamentation, however, is not to hide colors, but to show them—to brighten, not diminish their effect—and whatever interferes with this, is contrary to the spirit of ornamentation. Colors so affected cease to appear to be what they really are!

Thus, a black next to a red or green, or between these two, becomes a dull or rusty hue, and both the red and green lose by the arrangement. Introduce a white or a yellow next the black, and it at once regains its own hue ; others, again, raise the force of those they are combined with, as both white and black heighten the rose of the face, and these both too increase the paleness of a pale complexion.

Light colors also brighten deeper ones ; as white or yellow with red or blue renders them more lively ; if intermixed with them, it on the contrary diminishes their depth : thus, yellow, interwoven with crimson, gives it a scarlet tone, and white with blue, of course, lightens it.

Some are harmonious from one being warm and another cold ; as red and blue, orange and blue, brown and blue, and sometimes two cold colors harmonize, as blue and white.

The perception of harmony in the arrangement of colors is a natural gift, and can no more be acquired, than an ear for music can be acquired, when the natural faculty of distinguishing concord of sounds is wanting. No effort will compensate for the absence of the natural gift; but both the eye and the ear may be improved by study, as both may be impaired by bad habit.

The perceptive faculty necessary to the arrangement of colors in harmonious combination is not only a natural gift, but is a national trait. The Italians are the most gifted in decorative ornamentation, and the French, perhaps, come next. The Scotch are sadly deficient in this faculty, their efforts, so far, having resulted in the "Scotch plaid," which ought to be the emblem of discord. The Irish, too, display little or no taste in the arrangement of colors. They, as a people, seem to think that all the world should be one unbroken green, save here and there a speck of gold. The Dutch, who so far excel the French as artistic colorists—particularly, in imitating the colors of nature in landscapes—are far inferior to the latter in decorative ornamentation.

Colors in pictures do not, of course, admit of the same contrast as when applied to ornamental purposes; the mode of using them, also, is different, and the gray tints introduced into a picture prevent the contrast of the different colors being so strong and decided. Nor are colors for ornamental purposes to be used in the same way on all occasions. Those which would suit well for some purposes will not answer for other purposes. Those which are well adapted for furniture, or the decoration of a wall or ceiling, might not be suitable for dresses; and the colors which suit a lady's toilet would not, according to the prevailing taste, be admissible in the simpler costume of men in civilized communities. Colors which suit one complexion are not always adapted to another. The orange hue, which would be a favorite with a brunette, would be strongly objected to by the light-haired blonde. The latter would consider blue by far the preferable color.

In furniture, such as carpets, coverings, draperies, etc., it is better, as a rule, to attempt harmony by analogy rather than by contrast.

Reds, rich browns, crimsons, scarlets, and greens, with an admixture of orange or gold, produce much more satisfactory results than yellows and blues. The former wear better, and are much less likely to offend good taste than when contrasts are attempted. Yellows and blues—particularly light blues—soon acquire a worn, faded appearance, and lack the warm, genial effect so desirable in the place we call home.

It must not be supposed that, because certain colors are placed in juxtaposition by nature, such combinations must necessarily be harmonious. Nature delights in contrasts, and, while some flowers are most beautiful and harmonious in their colors, others are equally discordant.

In decorative ornamentation, Nature is not a safe guide; and it does not follow, that leaves and flowers and plants, so beautiful in the conservatory, may with equal propriety be introduced in patterns for carpets and hangings. In carpets, colors, not patterns, should be the chief object. It is of little consequence what the pattern may be, so long as the colors are arranged in harmonious proportion. No theory will serve to guide us in these matters. The general effect is what is most to be considered, the *tout ensemble*, as the French say. The detail is of little importance, so long as the general effect is pleasing; above all, the eye must not be offended by glaring contrasts. Gaudiness is always offensive to a cultivated taste.

Two colors agree—by the harmony of contrast, or by the harmony of analogy. To state the proposition more plainly—two colors agree by being like each other, or by being unlike each other, or by the addition of a third, which is wanting to produce perfect harmony; as an instance of the latter, may be mentioned blue and red, which are concords, but which require the addition of yellow, to make the harmony perfect. Among the most pleasing colors which harmonize with each other in pairs, are:

Blue and gold.
Purple and gold.
Green and gold.
Black and gold.
Crimson and gold.
Brown and gold.
Brown and orange.
Blue and orange.
Blue and scarlet.
Blue and black.
Blue and white.
Blue and chestnut.
Chestnut and orange.
Green and orange.

These are not, of course, all; but others harmonize in a less degree, and, as before said, some want a third to produce harmony. Some are disagreeable, and some positive discords. Among the wanting and disagreeable may be mentioned:

Blue and pink.
Blue and peach.
Blue and gray.
Blue and green.
Blue and blue-purple.
Orange and lilac.
Orange and drab.
Orange and gray.
Scarlet and brown.
Scarlet and chestnut.
Scarlet and drab.
Scarlet and green.
Crimson and purple.
Crimson and pink.
Crimson and gray.
Crimson and peach.
Yellow and red-purple.
Yellow and scarlet.
Yellow and gray.
Yellow and lilac.
Yellow and drab.
Red and green.
Red and blue-green.
Red and pink.
Red and buff.
Red and chestnut.
Purple and lilac.
Purple and slate-color.
Purple and brown.
Purple and stone-color.
Purple and gray.
Purple and pink.

Green and gray.
Green and drab.
Green and stone-color.
Purple and peach.
Purple and chestnut.

The discords in two colors are:

Yellow and pink.
Green and pink-red.
Olive-green and red.
Slate-color and green.
Pink and green.
Brown and green.
Chocolate and green.
Russet and green.
Blue-green and lilac.
Scarlet and olive-green.
Crimson and green.
Crimson and olive-green.
Mulberry and green.
Claret and green.
Lilac and green.
Red-brown and green.
Purple and citrine.
Blue-purple and green.
Purple and green.*

The colors which harmonize are:

Blue and red—but want yellow.
Blue and scarlet.
Blue and salmon-color.
Blue and orange—a most agreeable harmony.
Blue and yellow—harmonize, but not so rich as blue and orange. A blue should not be placed between two yellows, or a yellow between two blues, as a general rule.
Blue and white—but the white should be in excess.
Blue and black.
Blue and chestnut—have a rich effect.
Blue and chocolate—harmonize.
Blue and stone-color.
Blue and drab.

* The worst kind of discord. This applies to all purples and greens.

Blue and green—but want orange.
Blue and purple—but want scarlet and gold.
Yellow and black—not so good as orange and black.
Yellow and green—inferior to orange and green.
Yellow and chestnut—not so rich as orange.
Yellow and brown.
Yellow and purple.
Yellow and red—but want blue.
Yellow and crimson—inferior to orange or gold and crimson.
Gold and green—very pleasing harmony.
Gold and blue—very pleasing harmony.
Gold and crimson—very rich.
Gold and purple.
Gold and scarlet—rich but inferior to gold and crimson.
Gold and chestnut—rich harmony.
Gold and lilac—harmonize (as do gold and lavender).
Gold and black.
Gold and white—harmonize, but wanting.
Orange and yellow—a good effect by gaslight.
Gold and gray—harmonize, but cold and wanting.
Orange and black—harmonize better than yellow and black.
Orange and chestnut—agreeable harmony.
Orange and purple, or red purple.
Orange and puce.
Orange and green—very agreeable harmony.
Orange and gold—harmonize by analogy, but wanting; orange will not take the place of gold, and an orange ground is cold and dead compared to a gold one.
Orange and crimson—rich, but want blue.

Red is less suited for ornamentation than scarlet and crimson. (In flowers, red is the color of the original *Verbena Melindris.*

Red and gold—harmonize, but inferior to crimson and gold.
Red and gray—harmonize.
Red and white—harmonize, but the white must be in excess.
Slate-color and black—harmonize.
Slate-color and scarlet—harmonize.
Slate-color and gold—harmonize.
Black and white—harmonize by contrast.
Black and yellow.
Black and buff—but the black overpowers its companion.
Black and scarlet—harmonize, but wanting.
Black and blue—harmonize, but gloomy.
White and gold—harmonize, wanting by daylight, but light up well together.
White and red.
White and scarlet.
White and crimson.
White and brown—but white should be in excess.
White and purple—but white should be in excess.
White and chocolate-color—but white should be in excess.

The most harmonious combination of colors with two or more companions are:

Blue and red (or scarlet or crimson) with yellow or gold.
Blue and scarlet, and purple and yellow (or orange or gold), and black.
Blue and scarlet, and yellow (or orange or gold), with a small quantity of (bright) green.
Blue and scarlet, and gold and white.
Blue and scarlet, and white and purple, and yellow (or better, gold or orange).
Blue and yellow, and scarlet, and white and black, and orange and green.

Orange and blue, and green and white, and black.

Crimson (or scarlet) and yellow, and blue and white, and black.

Blue and yellow (or orange), and purple and scarlet (or crimson), and white and black.

Blue and scarlet, and green and yellow (or orange and gold), and black and white, and purple and scarlet, and gold.

The orange is not a red, but yellow orange. When scarlet is used instead of crimson, the quantity of yellow must be lessened, and when yellow is used in place of orange, it must be in less quantity. Green must be in smaller proportion to the other colors, and of bright color.

The harmonious combinations of three colors are:

Blue and red and yellow—if in proper proportion.

Blue and scarlet and yellow.

Blue and crimson and yellow.

Blue and crimson and orange.

Blue and crimson and gold—very rich in furniture.

Blue and crimson and scarlet—but want green and yellow.

Blue and red and white—cold.

Blue and scarlet and white.

Blue and scarlet and orange—but want black.

Yellow and scarlet and purple—but want blue.

Yellow and crimson and purple—but want blue and chestnut.

Purple and scarlet and gold.

Purple and scarlet and white.
Purple and orange and crimson—but want blue.
Lilac and scarlet and gold.
Lilac and scarlet and black.
Lilac and scarlet and white.
Lilac and crimson and gold (or orange).
Lilac and white and gold—but want scarlet and black.
Lilac and white and blue—but want black and scarlet and gold.
Black and white and scarlet—harmonize well.
Black and white and crimson—harmonize well.
Gray and scarlet and blue—harmonize.

The harmonious combinations in four colors are:

Blue and red (or scarlet) and yellow and brown—harmonize, but poor.
Blue and red (or better scarlet) and green in small proportion and yellow (or gold or orange).
Blue and red (or scarlet) and black and yellow.
Blue and red and black and white—but rather cold.
Blue and red (or scarlet) and white and gold—the white being in small quantity.
Blue and red (or scarlet) and white and yellow.
Blue and chestnut and scarlet (or crimson) and orange (or yellow).
Blue and crimson and purple and orange.
Blue and scarlet and purple and gold.
Blue and scarlet and purple and yellow.
Blue and scarlet and purple and orange.
Blue and scarlet and purple and white.
Blue and scarlet and maroon and orange.

Blue and scarlet and green and white.
Blue and black and white and orange.
Red and black and white and gold—wanting.
Lilac and scarlet and gold and white.
Lilac and scarlet and black and white.
Black and white and scarlet and blue—cold.
Black and orange and scarlet and blue.
White and black and orange and red—want blue.

The harmonious combinations in five colors are:

Blue and red (or scarlet) and white and green and yellow (better gold or orange).
Blue and red (or scarlet) and white and purple and yellow (or rather gold or orange)—harmonize well.
Blue and red (or scarlet) and green and yellow (or gold), on white ground—harmonize.
Blue and red (or scarlet) and yellow (or gold) and brown and white.
Blue and red (or scarlet) and yellow (or orange or gold) and purple and black.
Blue and red (or scarlet) and orange and chestnut and white.
Blue and red and yellow and black and white.
Blue and orange and green and black and white.
Blue and chestnut and yellow and black and white.
Blue and orange and green and purple and scarlet.
Blue and crimson and green and yellow and scarlet.
Blue and crimson and yellow and white and scarlet.
Blue and chestnut and scarlet and orange and purple.
Purple and yellow and black and blue and scarlet.
Lilac and scarlet and gold and black and white.
Lilac and scarlet and yellow and black and blue.

Black and white and scarlet and blue and yellow (or gold), harmonize.

Black and white and orange and blue and crimson, harmonize.

Black and scarlet and blue and green and yellow (or gold, which is better), harmonize.

Black and orange and blue and white and scarlet, harmonize.

Harmonious combinations of six colors are:

Blue and scarlet and green and yellow and black and white, harmonize.

Blue and scarlet and green and orange (or better, gold) and black and white.

Blue and scarlet and yellow (or orange or gold) and purple and black and white, harmonize well.

Blue and crimson and yellow (or orange or gold) and purple and black and white.

Blue and scarlet and yellow (or orange or gold) and black and white and brown (or chestnut).

Blue and crimson and yellow (or orange or gold) and black and white and brown (or chestnut), harmonize, but scarlet is better than crimson.

Blue and crimson and yellow (or orange or gold) and green and black and white, harmonize, but scarlet is better.

Blue and scarlet (or crimson or red) and orange and purple and black and a little yellow, harmonize.

Blue and crimson and orange (or gold) and purple and black and white, harmonize, but want yellow.

Purple and orange and scarlet and blue and black and white.

Lilac and scarlet and gold (or orange) and blue and black and white.

Harmonious combinations of seven colors:

Blue and scarlet (or red) and orange (or gold) and a little green and purple and white and yellow, harmonize, but want black.

Blue and scarlet and orange and green and purple and yellow and black.

Blue and scarlet (or red) and yellow and green and orange and black and white.

Blue and scarlet (or red) and green and orange and black and purple and white.

Blue and scarlet (or red) and black and white and yellow and brown and purple.

Blue and scarlet (or red) and black and white and orange and purple and brown, harmonize, but better without the purple.

Blue and crimson (or scarlet) and orange (or gold) and black and white and purple and yellow.

Harmonious combinations of eight colors:

Blue and scarlet (or red) and green and orange and black and yellow and purple and white.

Blue and crimson and yellow and black and brown and orange and green and white.

Blue and crimson and yellow and black and a little green and orange and white and purple.

Blue and crimson and yellow and black and chestnut and orange and white and purple.

Blue and crimson and yellow and black and chestnut and scarlet and orange and purple.

Blue and crimson and yellow and black and white and brown and orange and purple.

Blue and crimson and yellow and white and black and purple and scarlet and brown.

Blue and scarlet and yellow and black and white and brown and orange and purple.

Blue and scarlet and yellow and brown and black and white and orange and green.

Purple and orange and a little green and scarlet and blue and black and white.

It has not been thought necessary to mention the combinations with drab, fawn, and stone-color, or with all the hues and tones of the primaries and secondaries. Some of the former are better suited for grounds than for any marked position in colored composition. As has been before remarked, the proper proportions of the colors are indispensable. To be all of the same quantity would be fatal to them, as some are required to be in larger, and others in smaller proportions to them; as when red and blue and yellow are put together, the same quantity of yellow as of blue and red would be disagreeable; but it is difficult to determine the exact quantity.

It may be laid down as a general rule, when blue and red and yellow are put together that the greatest quantity should be blue, then red, then yellow. In all cases when green is used, it should be bright and of smaller proportions than the other colors.

In closing this chapter on the harmonies of colors, the writer would again call attention to the fact that no theory can teach the proper combinations and proportions of colors for ornamental decoration. The eye is the proper judge of colors and the perception of color is a natural gift. This may be improved by study but cannot be acquired. Those having the charge of our common schools can do more to disseminate taste through the country and encourage the various branches of ornamental art, than all the rest of the people combined. The community will not have a feeling for art of any kind, until the study becomes general; and the minds of those who make, as well as of those who use, must be imbued with a true perception of the beautiful.

The walls and ceilings of our public schoolrooms should present the best examples of colored ornamentation which the skill of our country can produce. It is absolutely necessary that all should have the eye and mind directed to the perception of what is good, for it is not enough that good taste be possessed by the few, while the community generally continues to be unconscious of its beneficent influence. For taste to last and become general, its rise and progress must be simple and gradual. It must be sown and reared, and will never flourish by mere transplanting.

Begin at the beginning! Commence the education of the perceptive faculties by good examples, at the same moment that you commence by precept to instill into the youthful mind the simplest rudiments of a common-school education. It cannot be doubted that there are in our common schools thousands of children who possess the natural gift of the perception of color in an extraordinary degree. But how shall this genius (so to speak) become valuable to the possessor, or to the community, unless some means are taken to educate, and develop, and direct it? Let those who have special charge of the education of our children be impressed with the fact that the employment of the very best Italian artists, in the decorative ornamentation of our common-school rooms with colored designs, would be a most economical expenditure of money, and would do more toward the general diffusion of taste throughout the country than all the other influences combined could effect.

CHAPTER XXVI.

CONSUMPTION OF PAINT IN THE UNITED STATES.

No attempt, it is believed, has been made before this, to estimate the total yearly consumption of paint in this country. That we consume vastly more than any other people, will not be questioned. The painting of houses in the six New England States requires probably more material than is used for that purpose in all Great Britain. This statement may seem exaggerated, but the probable correctness of it will appear when consideration is had of the large proportion of wooden houses which require painting and constant repainting; of the general use of soft wood in our houses, out-buildings, and fences; and of the passion of our people for freshly-painted apartments, and bright, cheerful exteriors. If any fondness for antiquated, time-stained edifices exists among us, it has up to this remained dormant. Possibly there may be latent somewhere a veneration for such objects, but our eagerness in the race of life has not afforded time for its development. Rejuvenation, rather, is the rule; for, when a building cannot be made young again by alterations and modern adaptations, the work of demolition proceeds, and almost as by magic the old gives place to a new structure, which, in its architectural proportions and ornamentation, exhibits the prevailing taste of the day, and which includes in its internal arrangements all the conveniences which an inventive people have been able to devise.

Old New York has been almost entirely rebuilt within the present generation; and many young New-Yorkers have witnessed the erection and demolition of houses which were considered, in their day, models in the way of architectural design and finish, and the erection in their places of still more elegant and costly structures. This constant tearing down and building up very materially increases the consumption of paint. Atmospheric influences, too, are more active in hastening the decay of paint in this than in countries which are not liable to the same extremes of heat and cold, of dryness and dampness. Our bright summer sun destroys the water-proof property of the oil, and the fierce storms of winter wash away the coating which has become disintegrated by the burning sunshine.

It is not claimed that the figures here given are strictly correct. In some cases they are only approximately so, as for instance in the matter of ochrey earths. Many substances of this nature are used as paints, which are quite unknown outside the locality where they occur, and which have, consequently, only a local consumption. So, too, in a measure with chemically-prepared colored pigments. These are manufactured at so many places, and the quantities produced by the different manufacturers vary so much, that no reliable data can be obtained.

The total product of the different manufactures of white lead and zinc can be arrived at with satisfactory exactness, as can the amount of those articles which are entered for consumption at the custom-houses.

For convenience, the figures are given in round numbers, and may, consequently, in some instances, exceed the amount actually consumed or produced; but, as in other cases the figures will fall short of the amount, the total will be in the main correct and reliable.

	LBS.
The total domestic product of white lead for 1867 was not far short of eighteen thousand tons, equal to	36,000,000
The quantity of imported white lead, both dry and ground in oil, was about three thousand tons, equal to	6,000,000
Of white zinc, the home production was seven thousand five hundred tons, equal to .	15,000,000
Of sulphate of baryta, which is almost wholly consumed in the cheapening of white lead and zinc, and as the base of colored pigments, twelve thousand tons, equal to .	24,000,000
Of yellow ochres imported from France, three thousand casks, about one thousand tons, equal to	2,000,000

Of yellow ochres and other earth-paints of home production, one thousand five hundred tons, equal to	3,000,000
Of Venetian red, imported from England, seven thousand barrels, or one thousand tons, equal to	2,000,000
Of colored pigments, including those imported, and including white zinc imported, say four thousand tons, equal to	8,000,000
Of whiting and Paris white, most of which is consumed as paint, eighty thousand barrels, equal to	30,000,000
Making a total of	126,000,000

The proportion of these paints used in water is inconsiderable when compared with the amount consumed as oil-paint.

The quantity of linseed imported during the year 1867 was about two millions of bushels, which would produce four millions of gallons of oil, equal to thirty millions of pounds. The domestic crop of flax-seed is estimated at two millions of bushels, equal to four millions of gallons of oil, or thirty millions of pounds. The quantity of linseed-oil imported was one-quarter of a million gallons, equal to one million seven hundred and fifty thousand pounds.

Making a total of four and one-quarter millions of gallons of oil as the year's consumption.

Of this quantity, it will be proper to deduct two hundred and seventy-five thousand gallons as having been consumed by varnish-makers, and in the manufacture of printer's ink say eighty thousand gallons, making a total of three hundred and sixty thousand gallons.

Supposing the stock of linseed and oil on hand at the beginning of the year 1868 did not exceed the stock on hand at a corresponding period of the previous year, the above figures show a consumption of nearly four millions of gallons used for painting purposes. The weight of this quantity of oil, added to the weight of the paints, gives the enormous total of more than one hundred and seventy-four millions of pounds of mixed paint consumed in a single year!

A fair estimate per pound of the money-value of this paint when prepared for use, would be twelve cents per pound, equal to twenty millions of dollars. It is estimated that the cost of labor, at present prices, in the various departments of plain and decorative house-painting, in comparison to the cost of materials, is as two to one. Supposing this to be a correct estimate, the money-value of the labor required to consume the given amount of paint would be forty millions of dollars: showing a total of sixty millions of dollars expended in painting our houses; and that, too, at a time when the demand for paint throughout a large portion of the country, owing to its impoverished condition resulting from the late war, has almost ceased.

The export of paint, owing to the uncertain value of our currency, and the high prices of labor and material which have prevailed during the last three or four years, is inconsiderable. Formerly the West Indies and the Central American markets were supplied from this country, but the trade has now fallen mostly into the hands of the English manufacturers.

CHAPTER XXVII.

WEIGHT OF PAINT AND MEASURE OF OIL REQUIRED TO COVER A GIVEN NUMBER OF SUPERFICIAL FEET OF WOOD OR BRICK.

THE figures given below are the result of careful and repeated experiments, made under the direct supervision of the writer. The wood used was ordinary machine-planed pine ceiling-boards of an average width of nine inches. Each succeeding coat was applied without rubbing the previous coat with sand-paper.

The paints were, in all cases, free from any admixture of adulterating materials, and were of the best quality. No rule can be given as to the exact quantity of oil required to reduce white lead or other paints to the proper consistency, under all circumstances, and for all kinds of work. A rough surface requires not only an increased quantity of paint, but an increased quantity of oil in proportion to the paint. The temperature of the atmosphere, too, affects the result; for although linseed-oil does not congeal except at very low temperature, it becomes less fluid as it loses heat, and consequently a greater proportion of oil is required in cold than in warm weather. Allowance must be made also for *waste* of material. A wooden package supposed to contain one hundred pounds of white lead will not afford a hundred pounds of mixed or thinned paint, minus the oil, for the reason that a portion of the oil in which the lead was ground will have been absorbed by the surrounding wood, and a portion of the lead will in consequence have become hard and unfit for use.

The amount of material thus wasted will depend almost wholly on the lapse of time ere the material shall reach the hand of the consumer.

The smaller the package the greater will be the proportionate loss. On one-hundred-pound kegs it will be from three to four per cent. To paint one square yard of the surface of wood, as before described, requires, for first coat, four ounces of pure white lead mixed with oil, in the proportion of seven ounces of oil to one pound of lead. Accordingly, to cover a surface comprising one hundred square yards, would consume twenty-five pounds of mixed (white-lead) paint, which mixture would consist of about seventeen and one-half pounds of ground white lead and seven and one-half pounds of oil, which is the exact weight of a gallon. Thus, one hundred pounds of ground white lead with forty-three pounds of oil will give a single coating to five hundred and seventy-two square yards of surface of moderately seasoned pine-wood. When the unpainted surface has become very dry and absorbent from long exposure to the weather, allowance must be made therefor. For a second coating, which should not, as a rule, be applied until after a lapse of six or eight days, the proportion of oil to the lead should be considerably less than for the priming coat, say at least ten per cent., or in the proportion of five gallons of oil to one hundred pounds of ground white lead. This mixture would give a coating to about six hundred and twenty-five yards of surface which had been once painted. Great care must be observed in applying the second and succeeding coats, that the paint be not too thin; particularly when the temperature is liable to become materially lower during the night. Otherwise the surface is liable to wrinkle, crawl, creep, as painters variously express it.

The foregoing observations as to quantity, etc., will apply to any number of succeeding coatings.

The sum of the foregoing is, that one hundred pounds of pure ground white lead, with the oil required to thin it, will give three coatings to two hundred square yards of ordinary pine-wood surface.

Where white zinc is used in place of white lead, the proportions and quantities materially differ.

To make a paint of dry white lead of the proper consistency to spread with a paint-brush, requires about one-half its weight of linseed-oil; while zinc, under the same conditions, requires nearly its weight in oil; hence it follows, that a very much smaller quantity of the latter oxide will be consumed in coating a given surface, than of the former.

As has been stated before, one hundred pounds of lead, with the requisite proportion of oil, will cover a surface of about five hundred and seventy-two square yards of new wood. The same quantity of white zinc, that is to say, one hundred and fifty pounds of zinc paint of the proper consistency for first-coating new wood, will cover about eight hundred square yards. The lead-coating, however, owing to its greater opacity, will better conceal the wood and give a more uniform surface than will the zinc paint. The cost of labor in applying the zinc, too, will be greater than the cost of applying the lead; so that, economically considered, there is not so great a difference in favor of the zinc as would at first sight appear.

(For the writer's views as to the comparative merits of these two most important pigments, the reader is referred to Chapter VIII. under the heading of White Pigments.)

Finely-ground French yellow ochre-dry requires oil in the proportion of about five ounces to two; that is, the proportion of oil by weight will be about five-sevenths of the mixed paint. One pound of this mixture will cover a surface of eight yards of new pine-wood, and the cost, in comparison with white lead, is about as five to ten, while in point of durability the difference in favor of the ochre substance will be much greater. On tin roofs, for instance, or other exposed situations, the ochre-paint would remain intact, when the white lead would have almost entirely disappeared.

Lamp-black requires more oil, in proportion, than any substance used in painting. One pound of pure black requires about two gallons of oil to make it of proper consistency for the painting of new wood. One pound of this mixture will cover about nine square yards of surface, and for second coating about sixteen square yards; a single ounce only being required to cover one square yard.

When spirits of turpentine is used, instead of linseed-oil, for thinning lead or zinc, as is the case in most interior work, the proportions differ very materially; as has been shown before, ground white lead requires, to thin to the proper consistency for painting surfaces which have been already painted, oil, in proportion of about forty pounds of the latter to one hundred pounds of the former. When turpentine is used, the proportions are about as one of the fluid to eight of the lead ground in linseed-oil. The quantity by weight of the latter mixture required to cover a given surface is about the same as of the oil paint, but the quantity of lead expended is much greater, of course, in proportion to the fluid.

SUMMARY.—One hundred pounds of pure white lead ground in oil require, to thin to a proper consistency for painting first coat, on new or unpainted pine-wood, about six gallons of linseed-oil at ordinary temperature.

One hundred pounds of pure white lead require, for painting a second and succeeding coats, about five gallons of linseed-oil.

One hundred pounds of pure American white zinc ground in oil require, to thin to proper consistency for first-coating or priming new pine-wood, about ten gallons of linseed-oil.

One hundred pounds of zinc as above, ground in oil, require, to thin for second-coating, about seven gallons of linseed-oil.

One hundred pounds of *dry* finest French yellow ochre require about twice its weight in oil (rather more than less), or about twenty-seven gallons of linseed-oil to one hundred pounds of the dry material. No reliable figures can be given for the thinning of yellow ochres and other earth-paints ground in oil, for the reason that ninety per cent. of such paints, when put on the market as "*ground colors,*" is very much adulterated with sulphate of baryta, which substance requires only about one gallon of oil to wet one hundred pounds of it.

Pure White Lead.—One pound of pure white-lead paint, made in the proportions as before given, will cover an unpainted pine-wood surface of about four square yards (rather more than less). For second and succeeding coatings the same work will require less than for first or priming-coat, and it is safe to say that one pound of pure white-lead paint will give four coatings to one square yard of pine-wood surface. (*See* remarks as to loss by absorption, waste, etc.)

One hundred pounds of pure white-lead paint will cover a surface of four hundred square yards of common machine-planed pine-wood such as is used for out-door finish.

Pure Zinc White.—One pound of pure

white zinc paint, mixed in the proportions before given, will cover a surface of unpainted pine-wood of more than five square yards, say five and one-third. For second and succeeding coats of same work the quantity required is about eight per cent. less, so that one hundred pounds of pure zinc paint may safely be estimated to cover five hundred and fifty yards of wood surface which has been already painted.

Yellow Ochre.—One pound of pure yellow ochre paint, mixed in the proportions before named, will give a first or primary coating to eight square yards of ordinary pine-wood sur face. These proportions will apply to the painting of tin roofs, but for such work the proportion of oil must be less than for wood.

Venetian Red.—One pound of pure Venetian red will give a priming-coat to about seven square yards of pine-wood surface, and a second coating to about eight square yards. The proportion of oil is somewhat less than for yellow ochre. It must be borne in mind, that in earth-paints the purer the material, the greater will be the quantity of oil required to thin the same to a proper consistency for spreading with a paint-brush.

LAMP BLACK, OR CARBON BLACK.—One pound of pure carbon black will cover a surface of painted pine-wood of sixteen square yards, and this surface, when not subject to abrasion from mechanical force or other accident, would remain intact for a century.

FOR PAINTING BRICK-WORK.—The experiments in this case were made on a surface of common hard rough bricks, laid in brown mortar with wide joints, out of doors, in winter, the atmosphere at a freezing temperature, and with the following results:

Of pure white lead, thinned with oil to the same consistency as for the first coating of wood-work, one square yard of rough brick surface requires about one half-pound of paint and but little less for second coat. A third coat, however, requires considerably less, and it will be safe to estimate the quantity necessary to give such work three coats, at one and one-quarter pounds.

For painting a surface of smooth-pressed bricks laid up with close joints, the quantity required for a given surface will be a little more than for painting new pine-wood.

Except in cases where white or very light tints are required, it is not advisable to use white lead paint for rough brick-work. The ochres, when the same can be either wholly or partially substituted for lead, will be found much more economical and more desirable.

Of Pure White Zinc.—One square yard of rough brick-work requires, for a first coating, about six ounces of thinned paint, or three pounds for eight yards. For second coating the quantity required is only about four and three-quarter ounces, and for a third coat about four ounces, showing a consumption for three coats of about fifteen ounces. So, one hundred pounds of mixed zinc paint will give three coats to more than one hundred square yards of rough brick surface.

Of Pure French Yellow Ochre, the quantity required to give a first coat to one square yard of rough brick surface is about the same as for zinc paint, that is, about six ounces; but for second coat the quantity required is only about three and one-quarter ounces, and for third coat about three ounces, showing a consumption of about three-quarters of a pound for three coats to the square yard, or for one hundred yards say seventy-five pounds of *pure* yellow ochre paint.

Of Pure Venetian Red, for such work the quantities are about the same as yellow ochre, and the figures given for that pigment will serve for this.

In painting brick-work good results are possible only under certain conditions.

This kind of painting should be done in dry warm weather, when the moisture which bricks absorb from the atmosphere during the winter and spring seasons shall have dried out; otherwise, the paint will not adhere tenaciously and will be apt to scale off. In exterior house-painting it is of very great importance that the work be dry when the paint is applied.

The reader will bear in mind the fact, that while the figures for the quantities of the various pigments required to cover a given surface are, abstractly considered, correct, they being the result of recent and carefully-conducted experiments (the figures being rounded to avoid the confusion which might ensue by extending them to the exact number of grains of material actually consumed on the various trials), there are modifying circumstances which must in the nature of things change the result when the figures are tested on a more extended scale.

A wooden keg, nominally containing twenty-five pounds of white lead or other paint, really contains but about twenty-three pounds of material, the weight of the package being included. There will be, from absorption and consequent hardening of the paint, an average loss of at least one pound of the contents of the package, so that only about twenty-two pounds will be realized, showing a difference between the nominal and the actual contents of the package of about twelve per cent.

The experiments, too, were made in every instance with the very best and purest materials, and under most favorable circumstances, and the same results must not be looked for when the pigments are inferior in quality and possess far less intrinsic value.

With an apology for the repetition, the writer would again remark that *good results* in painting can only come from the *use of good materials.*

It may interest the general reader to know that unsophisticated pigments are the exception and not the rule; that hundreds of tons of so-called white lead are annually sold in the United States wherein the highest chemical skill would be unable to detect a grain of the material, under the name of which this fictitious article is sold.

Many of the materials sold under various names and recommended for use in painting are in their nature totally unsuited for such purpose, being semi-transparent, and consequently wanting the property without which no pigment is valuable or economical for ordinary exterior house-painting; they are, too, coarse, gritty, and sandy, which renders the spreading of them, evenly, a task not easy of accomplishment. In hue, and tone of color, they are disagreeable and unpleasant. A dingy, chocolate-colored exterior is not in harmony with *any* landscape. No matter what the character of the structure may be—whether it be isolated or attached to other buildings—whether it be a corn-crib or a cow-house, if the same be worth painting at all, it is worth painting with some regard for the laws of harmony and the "fitness of things."

Every house, barn, out-building, or fence, becomes when painted a more conspicuous object in the landscape than it otherwise would be; and the cost of painting the same in conformity with the laws of harmonious arrangement and proper adaptation to the surroundings is no greater than to paint in such a manner as to set all these laws at defiance.

For example: the surroundings of most country-houses reflect to the eye the various hues of green. Now, red-brown and green in juxtaposition produce horrible discord. A yellow partaking of the orange hue, on the contrary, makes agreeable harmony. Red-browns and chocolate colors are altogether unsuited to the painting of country-houses. They are out of place in a landscape and cannot be made to harmonize with the surroundings. Some tone of yellow is preferable, particularly when the house has green blinds attached to the windows. It is not good taste, however, to use white for the trimmings, window-frames, cornices, etc., with yellow; white and yellow are poor and feeble and are wanting by analogy. The yellow loses by the connection; a rich shade of brown (not red-brown) is proper for trimmings, in contrast with yellow, and makes very pleasing harmony.

Bright-green blinds also are more agreeable with yellow than with any other color, which would be suitable for painting the exterior of a country-house. Next to yellow, the yellow-drabs and stone-colors are recommended.

No rule can be given which will serve as a guide in such matters, for the reason that what might be very proper and suitable under certain conditions, would be unsuitable and improper under other circumstances; and it is far more easy to point out what to avoid than what to adopt. When buildings are grouped, yet not connected, a very good effect may be produced by painting the smaller ones of a darker shade of the same hue as the principal or prominent building. Uniformity in such cases is by no means desirable, except when the object is to hide or diminish the lesser structures. As a rule, very dark colors are to be avoided in painting the exterior surfaces of wooden houses, not only because such colors are less in harmony with the surroundings, but for the reason that such colors do not preserve the wood so well as lighter tints, and so, are objectionable on the score of economy.

The painting of a building, however poor and mean the structure, affords some opportunity for a display of taste; and, as has been before remarked, the humblest individual may manifest an innate perception of the beautiful in the ornamentation of a cottage and in the poorest materials.

A man may perform the mechanical part in the operation of painting, faultlessly, and yet be entirely wanting in the faculty to arrange and dispose colors in harmonious combination.

Those to whom we intrust such work, should possess the natural gift of discriminating colors, educated by good examples, and be thoroughly imbued with love for the art.

THE END.